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PRESIDENT'S ANNUAL ADDRESS.

By PETER H. BRYCE, M. A., M. D.

Mr. Chairman, and Members of the American Public Health Association, Ladies and Gentlemen—It becomes my pleasing privilege as your duly elected President for the year 1900, to express to you my deep sense of the honor conferred upon my country and myself, as her representative, through your generous act. To have been called upon to preside over the deliberations of a congress, which is engaged in studying questions of vital interest to three nations and to ninety millions of people has, indeed, served to impress me not more with the magnitude of the work we are engaged in, than with the limitations of my powers to adequately fulfill the duties and responsibilities which the position involves. Allow me, therefore, ladies and gentlemen, to bespeak for myself your generous indulgence and kindly sympathy while performing the duties of your presiding officer; and for my excuse in those matters wherein I may fail, I must take refuge under that time-honored excuse expressed in the words of the old Latin poet—

> Si possem sanior essem,
> Sed trahit invitam nova vis; aliuque cupido
> Mens aliud suadet: video meliora proboque
> Deteriora sequor.

With the passing of more than a quarter of a century since the first annual meeting of this Association, many of its earlier members have ceased from their labors; but it becomes my official duty to record the untimely death of several members who have passed away while still in the prime of life.

I recall the names of Edward Oram Shakespeare, M. D., of Philadelphia, Penn., of George Edom Coulthard, M. D., of Fredericton, New Brunswick, of Henry Cooper Crouch, M. D., of Denver, Col., and of E. A. Guilbert, M. D., of Dubuque, Iowa.

To mention the name of Dr. Shakespeare is but to present to the mental vision the author of that classical work on cholera, which has supplied us with so comprehensive an outline of the conditions which have governed in the past, and still are largely present in outbreaks of this scourge of former times.

I can well recall Dr. Shakespeare, as he labored at quarantine on the Delaware, associated with State and municipal officers in

1892, to protect his city and country against the threatened invasion of this disease. Since then his kind and genial presence was with us at our meeting at Philadelphia in 1897. His demise has seemed sudden to many who knew nothing of his illness until his death was chronicled on June 1st.

Of Dr. Coulthard, the Secretary of the Provincial Board of Health of New Brunswick, it might be said that all who have known him during the past five years, during which he has regularly attended the meetings of the Association will retain a recollection of him as a gentlemanly but retiring man, but who proved on acquaintance a genial friend and an enthusiastic officer of health. His work was well known and appreciated in his own Province, while his activities as a physician and citizen in Fredericton were spoken of most favorably by the local press. In him the public health service in Canada loses an active and conscientious worker, and this Association a loyal member.

Of others who have passed away, the Association has had less opportunity of learning their worth. The positions, however, which they have held in their own State and city, have marked them as active workers in the field of Public Medicine, and they have passed *magna cum laude* to their rest with the honored dead.

But while I recall the memory of our dead, I take this opportunity of expressing as their official mouthpiece, the sense of pleasure which the members of this Association may fairly indulge in, as they find themselves greeted by the living representatives of this beautiful city in a State in what is rapidly becoming to us the older west. I am not exactly informed as to just at what age an American State attains its majority; but I assume that any State that has presented a President to the nation—and such a President as Benjamin Harrison—must be looked upon as having arrived at years of full maturity.

The Association trusts, however, that even a mature State may still find something of value to be obtained from having its sessions held in its capital city; and in return its members hope to bear away with them memories, not only of kindly welcome and generous entertainment, but also evidences of the application of science to public health problems in a manner often more easily carried out than where the traditions of the hoary past still linger.

The Association feels sure, however, that in a State whose earliest boundaries indeed, were embraced in those two wondrously euphonious words, "Ohio the Beautiful," and "Ouabache the White," that its members will experience from her citizens every kindness which can spring from those who live constantly under

the beneficent tutelage of the good deities of two such beautiful streams.

It has become the established custom of past years to summarize in the presidential address some of the more important phases of public health work, which have attracted scientific attention during the year preceding each annual meeting. The past year, like those which have preceded it, has also presented matters of interest, which might with profit be referred to; but as such will naturally engage our attention in the several papers to be presented at subsequent sessions, I have deemed it not inappropriate to attempt a survey of public sanitation as embraced in the history of social and scientific progress during the century just closing; and can hope that from such we may obtain some idea, however inadequate, of the truth, so beautifully expressed by Emerson in his essay on 'History,' "That there is a relation between the hours of our life and the centuries of time. As the air we breathe is drawn from the great repositories of nature, as the light on my book is yielded by a star a hundred millions of miles distant, as the poise of my body depends upon the equilibrium of centrifugal and centripetal forces, so the hours shall be instructed by the ages and the ages explained by the hours."

In order then, to obtain any adequate conception of the causes which have brought "Public Health" as a science to the position we find it occupying at the close of the century, we have to enquire into the influences which have been at work during the hours of the century, and of that period just preceding it, the "Renaissance," which may justly be called the birthday of modern science, and of which Carlyle said: "Behold a new era is come; the future all the brighter that the past was base."

Of it, as epitomized in the French Revolution, we may truly say that though its advent was marked by portents, agonies and birth-throes, yet there it stood an indubitable fact, with infinite potentialities, and having stamped upon its, as yet infantile features, the ineradicable birthmark, "The Rights of Man." For fifty years had France, England, Germany and America been sensible of the pulsations of a new being, and philosophy and science had conceived it and been its sponsors at the christening. Not, however, that in germinal force it had not existed earlier; for had not Copernicus, Kepler, Galileo, and Newton already lived and offered to the world divine gifts? But till now, as of the words of the great Moral Teacher of an earlier age, "The ears of men were deaf that they might not hear." Or as expressed by Carlyle: "Of a truth the long demonstrated will now be done: the age of revolutions approaches, but then of happy blessed ones. Man awakens from his long som-

nambulism; chases the phantoms that beleaguered and bewitched him."

To none more than to the sanitarian is it evident that the ethical element or "elevation in the scale of being" must ever be the measure of social progress; and hence it is that sanitary reform is intimately associated with the history of religious, political and social development; for our motto, "*Sana mens in corpore sano*," is but a terse expression of the fact that the science of Public Health relates to man in every phase of his being. Hence it becomes necessary that we review the social status of the peoples amongst whom modern science took its birth, in order that we may comprehend what progress has been made.

To mathematics, whose development first gave to that oldest study, astrology, a form and meaning, stripping it of its mysteries, and enabling men to establish the first truth of science, viz: 'The unalterable character of the laws which govern the universe and guide the planets in their course,' are we to look for the first evidences of that intellectual development which marked the 'Renaissance.' As a part of it began those experiments in physics, or natural philosophy, which had especially marked the genius of Galileo, and gave us some of the first crude scientific instruments, making deeper physical investigations possible. Slowly indeed were the swaddling bands of astrology and witchcraft cast off, and the reign of natural law inaugurated. But Bacon with his marvelous powers, had taught the inductive method, and pressed forward the idea of a scientific society which might give prestige to the work of original experiment, and which resulted in the Royal Society of England being founded in 1649.

By it first were published those discoveries of Newton which made the extension of his marvelous investigations possible to students on the Continent. Their supreme importance may be judged from the fact that in France, we find that the greatest scholars among the Encyclopædists were all mathematicians, and that D'Alembert, Lagrange, Helvetius and others won their membership in the Academy of Sciences by theses on some subject of natural philosophy. But with the foundation built on which the superstructure of science become possible, we find the spirit of investigation spreading into every field, and though editor Diderot saw volume after volume of his Encyclopædia seized under Royal interdict, yet in after years he saw them published even with Royal sanction, since in them the Royal mistress found the method of making rouge and manufacturing silks, and the King found described the method of making gunpowder. So it came to pass that this marvelous work of twenty-

one volumes became a potent agency in developing the spirit of the New Age over both Europe and America. To it D'Alembert, Helvetius, Turgot, Buffon, Condorcet, Marmontel, Rousseau and St. Lambert were contributors; while towering above them was patriarch Voltaire, as he was affectionately called, and of whom as philosopher, litterateur, poet and politician, Carlyle has said: "So far as present knowledge enables us to judge, it may be said that to abstract Voltaire and his activity from the eighteenth century, were to produce greater difference in the existing figure of things (1829) than the want of any other up to this day." Indeed then the thirst for knowledge may be said to have become a universal passion, and it is stated that at this time the sale of books in Paris was four times as great as in London. Remembering, as Lecky writes, "In France absolute monarchy had destroyed all liberty and all opposition; and having prevented a school of practical reformers, politics came to be treated like a problem in geometry or ethics, to be worked out on general principles with a complete disregard to the traditions and the special circumstances of the nation," it is little wonder that Rousseau's "Contrat Social" came to be looked upon as a new gospel, and for the influence it exerted we must class it with Adam Smith's "Wealth of Nations." How could it be otherwise when it set forth what were then new ideas, but to us now mere axioms: That, (*a*) Society originally was formed for the protection of the lives and property of those composing it; (*b*) that to live in peace and security was the right of individuals; (*c*) to this end certain organizations and laws were necessary; (*d*) that as to do this costs money, equalized taxation was necessary and majorities should rule. The outcome of such teachings to a people to whom science was revealing the marvelous secrets of nature and teaching uniformity of laws and the dominance of intellect is obvious. Of that ever memorable 4th of May, 1789, when Versailles saw the convocation of the States General, which had not met since 1614, in a country where existed "no habeas corpus act, no liberty of the press, no legalized religious liberty, no trial by jury, and no national representation," Carlyle says: "It is the baptism day of Democracy; sick Time has given it birth, the numbered months being run. The extreme-unction day of Feudalism; a superannuated Society decrepit with toils—is now to die, and so, with death-throes and birth-throes, a new one is to be born." Amidst all the horrors of that revolution, which advanced with lightning rapidity, there are to be observed the influences that preceded the 'Renaissance,' regarding which Talleyrand remarked: "He who did not live before 1789, has never known the charm of life." As expressed by Lecky: "The study of physiology, botany, comparative anatomy,

and electricity advanced with gigantic strides; and in the enthusiasm which prevailed, it was imagined that physical science would soon unlock the secret of the universe and disclose the mystery of life."

Lavoisier laid the basis of the science of chemistry, and Fourcroy by popular lectures made its study fashionable; Petit taught anatomy, Nollet electricity, and Arago astronomy; while Laplace, in his "Celeste Mechanique," gave to the world his nebular hypothesis, which at the end of this century still stands for us as a working theory of the evolution of the universe. And even though Mongolfier excited the wonder of the people by his balloons, and Mesmer cloaked a scientific fact with charlatanism; while Count Alessandro di Cagliostro "by profession healer of disease, abolisher of wrinkles, friend of the poor and impotent, Grandmaster of the Egyptian Lodge of High Science, spirit-summoner, gold-cook, Grand Cophta, Prophet, Priest, and thaumaturgic moralist and swindler," exploited the ladies of three courts, only to come to grief at last over the theft of the diamond necklace; yet there is the immanent fact that in the councils of this period of maelstrom ferment, when so many noble men were sucked into the vortex, there was a galaxy of earnest spirits filled with a love of truth, greater probably than was ever before gathered in the parliament of any nation.

It was as the Golden Age of Greece in art, or the glories in literature of the Elizabethan period. Tourgot, writer on economics, was Minister of Finance, and Helvetius, the mathematician, was Director of Forests and Farms and developed scientific agriculture. Laplace was a Secretary of State under the National Convention, while Lavoisier, whom the German, Wurtz, has called the father of French chemistry, was in the words of Lalonde, "to be found everywhere." And with what good reason amongst a people where the search after scientific truth was at fever-heat in every department of life. It was as when the prisoner comes from the close dungeon into the free air of heaven; he breathes deeply and again for fear he may lose it. The situation is epitomized in the life of Lavoisier, a model of what the man of science may and ought to be. Born in 1743, of wealthy tradespeople, he had all the early advantages of the schools of his time, studied mathematics, astronomy and botany assiduously, and became so absorbed in natural philosophy that at 23 years of age he gained the gold medal at the Academy of Sciences for a thesis on "Lighting of the streets of Paris." He analyzed gypsum, and is soon found touring France with Guellard and making a geological map, subsequently publishing "Memoires sur couches des Montagnes." At 26 years he was made one of the Farmers General, in order that his resources for advancing scientific study might be increased.

Imagine such a possibility to-day! He soon overtook the pneumatic studies of Black, Cavendish and Priestley, checked their errors and added to and gave form to their studies on air. Weekly experimental laboratory reviews of work done were carried on by him with Laplace, Mayer, Berthollet and Fourcroy. In 1778 he gave to Priestley's dephlogisticated air the name of oxygen, meaning thereby the acidifying principle; in 1784 he analyzed water, in 1781 synthesized carbonic acid, thereby making the first advance towards the analysis of organic substances, and in 1787, published "Methode de Nomenclature Chemique," a system of nomenclature which lasted for fifty years, and is the basis of that still in use. In social reform as a Farmer-General, he succeeded in having many oppressive taxes of the people removed, even from the Jews of Metz.

In 1776 he was made the director of powder-works by Turgot, soon quadrupled the output, and improved by one-third its explosive power. It was Lavoisier who made the chemical balance the *ultimata ratio*, and hence established the basis of quantitative analysis. He analyzed soils and manures and even doubled the product of his own farm. In 1787 he was the philosophical statesman of the Provincial Assembly of Orleanais.

In 1789, he reported to the National Assembly on "Caisse d'Escompte," and in 1790 sat on "The Commission of Weights and Measures"; while in 1791, as Commissioner of the Treasury, established a system of accounts hitherto unequaled; and soon he was asked to write a treatise on taxation, and wrote "De la richesse territoriale de la France." And now the political eclipse! On 2d of May, 1794, Dupin, in the National Convention, brought some frivolous charge against Lavoisier, and six days afterwards, he with twenty-seven others went to the guillotine, the brutal reply to a petition for a reprieve being, "The republic has no need for savants." Well were it for progress if the words of Lagrange regarding Lavoisier, were in these days of political *bouleversements* 'writ' large everywhere. *"Il ne leur a fallu qu'un moment pour faire tomber cette tete, et cent annees peut-etre ne souffiront pas pour en reproduire une semblable."*

But enough has been said to fully illustrate those widespread intellectual and scientific movements, which springing up so largely in France, spread even to the courts of Germany and Italy, and of the aristocratic throne of the Czars, and which laid the basis of the marvelous progress in practical science of the 19th century. Nor must it be supposed that these influences extended only to the progress of the pure sciences. Foundling and Magdalen Hospitals were founded, Abbe de l'Épèe invented an alphabet for the blind, and Houay founded an institution for the deaf and dumb, and asylums were

opened for the insane; while Frederic the Great made education almost compulsory in Prussia.

To England we must now look and examine a current of influences, arising from allied but different causes, and productive of a social progress based perhaps, upon a less exact intellectual and scientific foundation, and more upon what may be called the practical social needs of a people. The deep-laid religious convictions of their ancestors, who in a previous century had struggled for religious and political freedom at a time when France was under an absolute despotism, and which culminated in the Civil War and the Commonwealth under Cromwell, with the subsequent Revolution of 1688, and the establishment of a new dynasty on the throne had never been lost or seriously dissipated, especially among the agricultural and industrial classes, whether of England or her great colonies in America. It is true that the parties of the early part of the 18th century exhibited every shade of political corruption; but the idea of the liberty of the subject and of the constitutional limitations of the Crown, growing out of the Witanagemot of the old Saxons, was never lost; while the growth of colonies and of sea-going commerce kept alive a spirit of enterprise and independence of thought, which received added strength from the marvelous industrial progress of the latter half of the 18th century, due to the mechanical inventions which gave England that financial prominence which has marked her course through the 19th century. The French intellectualism of the 'Renaissance' found a congenial soil for its growth among the descendants of the Pilgrim Fathers and of those Virginian emigrants who for two centuries had breathed the free air of a new world, while the outcome of the War of Independence gave to a decadent Toryism in England its *coup-de-grace*.

Such were the influences which enabled the younger Pitt, at the age of twenty-five, Premier of England, to be surrounded by men of unusual intellectual strength, and which carried England safely through the trying years of the French Revolution and the Napoleonic wars; while by France the world was taught very many lessons of what a people once in thrall may become and do when, imbued by the truths of the "Contrat Social" and the "Rights of Man," they strike for individual and National freedom. England had, with the growth of the colonies and the founding of the new empire in India, been developing her commerce during the reign of the first Georges; but this progress became rapidly accelerated from 1750 onward, owing to several remarkable mechanical inventions in manufacturing machinery.

Of these the inventions for the manufacture of cotton goods were the greatest in their immediate results. The stories of how Har-

greaves invented the spinning-jenny, and Arkwright increased many times over, by the use of rollers, the amount of yarn made, and of how Cartwright made the power loom and cylinder presses for printing cotton goods, have all been told again and again; while the improvements of Watt, once a Scotch watchmaker, in the steam engine, making almost the very machine we see to-day, which enabled Arkwright to run his machines by steam, and Engineer Rennie set the wheels of the great flour mills revolving by the same agency read like a romance. If to these we add the improvements made in the manufacture of iron and the extension of the use of coal, and the construction within a few years of miles of canals, making cheap transportation, we may understand some of the principal influences which give a preeminence to England in commerce, while entirely altering both her internal economic conditions and her foreign policy. Manchester, Liverpool and Glasgow sprang from small towns into cities, and agricultural England by the end of the century had become a country of large urban populations, with mercantile fleets upon every ocean. Indian nabobs returned home to spend their millions of rupees, while with the rise of wages were begotten higher modes of living, associated with a sense of educational needs, all stimulated by the intellectual 'Renaissance' on the Continent. What this industrial expansion means, may be gathered from the fact that within the 40 years up to 1840, the number of those engaged in the cotton manufacture in England, had risen from 80,000 to 833,000; while the population of Lancashire alone, during the 18th century, rose from 166,-200 to 672,000. To-day it is over 4,000,000.

To these causes so briefly summarized, are we to look for the beginnings of what we now call State Medicine, of which England has, during the 19th century, been the most fruitful field. Up to the end of the century, the sudden expansion of her foreign trade, owing to these discoveries, and the high prices consequent upon the Napoleonic wars, created such high rates of wages, and so great general prosperity, that the sanitary evils which were rapidly growing up with the development of the factory system, were as yet hardly noticed. But the escape from a calamity such as had overtaken France in the National Revolution, had accelerated what is called the "Evangelical movement" in England, so large a factor in educating the national conscience, to a sense of the truth of the scripture, "that man is his brother's keeper." Associated with the younger Pitt, the model of the domestic statesman, as a personal friend, was William Wilberforce, whose broad christianity and sound common-sense served to make him the first social reformer, whose energies as a legislator were definitely devoted to the amelioration

of the condition of his fellowmen; while he was supported outside by the Society for the Abolition of the Slave-trade amongst whom the Quakers were the most active. Public meetings were held and statistics were carefully collected to show the inevitable horrors of the traffic. Wilberforce presented, in 1788, no less than thirteen petitions to Parliament, praying for its abolition; and the first steps were taken in that year to mitigate the horrors of the ocean passage. The opposition was great and the fight prolonged. But that strong, practical conscience of England, which time and again has forced Parliament to act, as in the reform bill of 1832, and the repeal of the corn laws in 1846, had been aroused; and the people proved their sincerity by multitudes refusing to use sugar, as being a product of slave labor. This education of the public conscience by public meetings, was now for the first time becoming a normal instrument of politics, and of such influence under popular government we, in our day, are fully convinced.

This anti-slavery crusade was but another phase of a work, which may be looked upon almost as the first attempt at sanitary reform, viz., the investigation of the prisons of England and the Continent, by John Howard. First captured at sea in 1756 by a privateer and sent to a French prison, he had personal experiences of the abuses which existed; and in 1753, as High Sheriff of Bedfordshire, he had ample opportunities of studying the prisoners under his charge. Till his death in 1790, prison reform became his life-work, and to Britain and the countries of Europe he revealed a mass of mal-administration and atrocious treatment, which made the most indifferent assume an interest. Insufficient food and starvation, only prevented by private charity, no sewers, no infirmaries, and no means of warming prisoners, and almost no water were as a rule to be found; while prisoners were crowded "in dark subterranean dungeons, reeking with pestilential effluvia." In most prisons there was no allowance for bedding or straw to lie on; and even if obtained it was not changed for months. There was almost no ventilation, owing to the window tax; and so vile was the air "that Howard declared that after visiting the prisons his clothes were so impregnated that he could not bear to drive in a post-chaise with closed windows." Naturally in such a place human life rapidly withered, and scurvy was deadly; while typhus, called gaol fever, raged with such virulence that more prisoners died from it than from the gallows, while prisoners if discharged became sources of contagion wherever they went. Many gaols were private property, and here, as in too many public ones, evils of even a grosser kind prevailed, for chains, iron-collars and even iron-bars, removed by brutal gaolers only for bribes, were in use; while

lunatics were often added, making pandemonium of Tartarus. Old and young, male and female, were indiscriminately huddled together, and prisons for punishment became schools for vice. Such conditions seem to have been worse in England than in some other countries, as Holland and Switzerland, where Howard was told that gaol fever did not exist. Though Pitt recognized the evils and need of reform as pointed out by Howard, but little was accomplished until the times of the great reforms in the third decade of the 19th century. Reference has been made to the great and rapid development of factories and the aggregation in towns of a population largely rural. One of the greatest evils resulting from this was the employment of cheap child-labor, so many men being drafted away to the continental wars. Indeed, so completely did the great Pitt misconceive the situation, that in speaking about the laboring classes he pointed out how much was got from the industry of children and the advantage of employing them at an early age. Indeed, many were sent out at ages of from 6 to 10 years, from workhouses, and contracted for, commonly working in factories from twelve to sixteen hours daily, as was proved by Parliamentary enquiry. Curiously, as a result of this industrial development, there took place the immense increase of negro slavery in America, which, as pointed out by John W. Daniel of Virginia in his famous oration on Jefferson Davis, had been protested against in 1727 by South Carolina, and prohibited by law in Georgia in 1760, while Virginia taxed every owner $10 per slave. Indeed, as remarked by Lecky, it seemed at the time of Washington, "likely to be extinguished by an easy and natural process." How slow, in the face of the growing influence of the great centres of manufacture in England, was the growth of factory acts and public health legislation, we shall see as we trace the progress of the 19th century.

As regards the evolution and progress of public health during the present century, there would seem to be four periods more or less distinctly marking its growth and that of those sciences which form component parts of it. These are:

(1) The period of Investigation, extending to about 1830.
(2) The period of Agitation, extending to 1850.
(3) The period of Legislation, to 1875.
(4) The period of Elaboration and Development.

We shall refer briefly to each of these.

(1) *The Period of Investigation.* The opening year of the century is notable because of the establishment in London of the Royal Institution, originally conceived as an establishment for the benefit of the poor. This institution has a special claim upon the interest of this

Association, since its foundation was due to the efforts of Benjamin Thompson, Count Rumford, a Royalist American, who, going to Europe after the Revolution, had engaged in various services in different countries. His labors were in the field of philanthropy, where he specially endeavored to have science applied to domestic economy, and particularly for having cheap foods supplied for the needs of the poor in London and other large cities. It was intended to institute a system of popular lectures in order that a practical knowledge of inventions and of the means of obtaining the comforts and conveniences of life might be rapidly diffused. Humphry Davy, then a budding natural philosopher, was fortunately appointed first lecturer on chemistry, and succeeded in a remarkable way in interesting the public in his discoveries and in popularizing science in England. A lecturer of marvelous power, he traced out in the introductory lecture of 1802 the resources of science for humanity, and dwelt upon its dignity and nobility as a pursuit, and upon its value as a moral and educational force. The lecture created a sensation, Davy became the lion of fashionable society, and for thirteen continuous seasons gave lectures on many and most varied subjects, from "laughing gas" to the constituents of artificial manures for agricultural purposes. But most to be remembered is that invention, the miner's safety-lamp, the result of a few months' experiment, which he had undertaken at the request of those specially interested in coal-mining. Seldom, if ever, has the sanitary value of a single invention been so quickly appreciated, and its benefits so strikingly illustrated; and yet when asked to patent the discovery, Davy wrote: "I never thought of such a thing; my sole object was to serve the cause of humanity."

In addition to the number of splendid workers whom Lavoisier left behind him in Paris, as Laplace, Fourcroy, Guyton de Morveau, Gay Lussac, Berthollet and Humboldt, England possessed other investigators, who, if not popularizing science, were perhaps adding, even more than Davy, to what has proved of extended permanent value. Of these, as the scholarly physician and conscientious investigator, was Dr. Wollaston, who, regardless of money, devoted himself in 1801 to pure chemistry, and was among the first to begin its application to physiology. He made platinum invaluable and gave us the theory of chemical equivalents; dipped into electricity, and came to be regarded as the greatest master of pure chemistry of his time. He died in 1828.

Alongside with his work must be placed that of the Quaker schoolmaster, Robert Dalton, since his work was especially in that branch which we now call chemical physics. His chief work was done in

that centre of industry, Manchester. He has been called the father of modern meteorology, and did more to establish the laws of gases or elastic liquids than any who had preceded him. He it was who first pointed out that aqueous vapor was mechanically combined in the atmosphere, and that each therein is subject wholly to its own laws. His experiments on dew and moisture were wholly new, and he gave us the earliest definition of the "Dew Point." He pointed out that fluids could conduct heat as well as convey it by convection, and demonstrated the important fact of heat being produced by mechanical pressure of air, and cold by its rarefaction. He likewise demonstrated that springs owed their origin to rain falling on the surface. He established the law of the expansion of gases, and constructed the hydrometer, and proved that the amount of evaporization in any given time was strictly proportionate to the force or pressure of aqueous vapor at the same temperature. His work in this field of pneumatic chemistry first led him to theorize as to the constitution of matter, and to him we owe the first clear conception of the atomic theory as we find it to-day, but little modified, and taking hydrogen as unity he determined the weights of many elements, and the law of multiple proportions through the constitution of the elements in compound bodies. Questioned and doubted, his discoveries were substantiated, and Davy asserted that the "Atomic Theory" was the greatest discovery of the age, and placed his services to chemistry on a par with those of Kepler to astronomy. His useful life was extended till 1844, and we find in him one of the Nestors of the British Association for the Advancement of Science.

In Dr. Thomas Young we have the third of a triad of great men grouped together by the first President of the British Association, as making glorious the scientific history of this period of our century. He it was who first established the wave theory of light; he made deep researches in electricity, and was valued for his mechanical knowledge as well as for his knowledge as a physician. Equally celebrated in science, which knows no country, was Berzelius of Sweden, and Gay-Lussac, Ampere, Volta, and Oersted and Arago in France, and Ohm, Seebeck and Becquerel in Germany, whose discoveries only awaited the wizard touch of the Canadian-American, Edison, to cast the rays of a search-light on a whole region whose mysteries had hitherto remained concealed. Following the labors of Lavoisier and his associates in France, and of Werner in Germany, but at a later date, this period saw laid the foundations of geological science in England, when Mr. William Smith published his map of the strata of England and Wales. Dr. James Hutton and Dr. John Playfair had both preceded him in Scotland, and explaining the past by the pres-

ent, had appealed to the action of streams and seas, and the processes of decay and reconstruction to account for the changes of which the earth's crust bore records. They boldly led the mind back to an illimitable past for an explanation of world-phenomena, and like Galileo, once more dared the anger of those whose Biblical cosmogony had so long obstructed the rational interpretation of the phenomena of Nature. Into the ever-widening field of investigation came Lyell and Sedgewick, Buckland and Murchison, until in 1830 appeared Lyell's "Principles of Geology," which became for thousands of students an open sesame to Nature's wonders. With students as Buffon and Cuvier in zoölogy, Louis and Dupuytren in medicine and anatomy in France, and Hunter and Jenner in England, it was evident that the *disjecta membra* of science must soon be brought together, when the phenomena of the external world could be utilized to interpret the laws of the physical system of man. At the beginning of the century the medical profession in England, was represented by an array of surgeons, physicians and apothecaries and an array of nondescripts from tooth-drawers and cutters to barber-surgeons, subject to no controlling body and unrecognized by law. In 1815 the Apothecaries' Act was passed, prohibiting practising without a license, but excepted the Licentiates of the Universities of Oxford and Cambridge, of the Royal College of Physicians, and of the Royal College of Surgeons; and henceforth gave a definiteness of direction to Medicine in England, which had already made the schools of Paris, Vienna and Edinburgh famous, but which, as we learn from Dr. Oliver Wendell Holmes, was long indeed in extending its influence across the ocean to America. What England and her daughter lacked then was, what Sir David Brewster, a President of the British Association, lamented as late as 1840, viz: "A National Institute wherein men set apart and paid by the nation could devote themselves wholly to the study of science." As neatly expressed by Rev. Mr. Harcourt, the first President of the British Association, in 1831: "The mining field of discovery seems to me to show on the one part the ore breaking out on every side, and on the other a multitude of hands ready to work it; but no one engaging them to labor or showing them in what manner they may employ their industry to the best advantage." We have already seen how the century opened with a nation awakened into a new life of industry whether on farm or in factory. The drain of men to the Napoleonic wars and the constant demand for workers for the arts and manufactures had supplied abundant labor and high wages in England for all; but with 1815 came a sudden change which was first to create a period of unprecedented misery and discontent, succeeded by social agitations

whose outcome none could see; but which were the precursors of that glorious period of reform of which the sanitary improvement of the people formed so important a part. The cotton trade had till 1815, with good prices, steadily developed, but now fortunately another great step forward became possible, which by greatly extending its manufacture, gave employment which lessened the prevailing social misery. The power-loom, hitherto an imperfect success, and machinery for spinning, were perfected far beyond the capacity for weaving the yarn into fabrics; while the supply of cotton had been enormously increased by the ingenious invention by Eli Whitney, an American, of the cotton gin. But the Jacquard loom so multiplied production that the looms increased from 3000 in 1815 to 30,000 in 1825, and the output from 82,000,000 to 230,000,000 pounds. On the other hand some 250,000 hand-loom weavers were being displaced, and ruin and destitution followed. To the discontent caused in this way was to be added that of disbanded soldiers and a farming population, where prices had fallen from 74s. to 43s. per quarter for wheat in three years, while even bread, boots and salt were taxed. As a result, discontent, rioting, destruction of machinery and violence marked the years succeeding the war, while agitation for reform was spread through a growing free press. Luckily, in William Cobbett was found a reformer who was not a revolutionist, and the "Hampden Club" urged peaceful methods, and especially workingmen's clubs, and found support even amongst the upper and middle classes. The first step forward was in 1823, when the protective navigation laws were repealed, and in 1826, even the corn laws were modified by the sliding scale; while the introduction of railway legislation in 1823, by which an immense demand for labor and capital was made, seemed further to lessen the miseries of a long commercial and agricultural depression. Already had Fulton steamed his vessel up the Hudson in 1807, and another crossed the Atlantic in 1819; while George Stevenson was giving a practical value to locomotives, of which one had worked on the roads of Paris as early as 1769, and in 1823 there was a charter given for the first railroad, 40 miles long, built by him and operated by an engine essentially the same as that of to-day.

With such era-making inventions marking the progress of science and the diffusion of knowledge of the universe and the capacity of the human intellect to overcome difficulties, it was natural that society at large should become conscious not only of its needs, but also of the right and possibility of having them supplied. Hence in the working classes, among whom wages still remained low and the conditions under which they lived showed but little improvement, there grew a deep-set determination to assert and obtain their rights.

Trades-unions grew apace, and even a Conservative Government gave partial legal rights to these organizations.

(2) *The Period of Agitation.* The agitation was always for the recognition of popular rights. The year 1829 saw in England the Catholic emancipation bill passed admitting Catholics to the rights of free citizenship, while a bill for Parliamentary reform, the agitation for which had convulsed the kingdom from end to end, became law in 1832. In 1833 the results of the long agitation by philanthropists were crystallized in a bill for the abolition of the slave trade in the British colonies; in 1834 the growing evils of pauperism were checked by the enactment of a new poor law, while in 1833 the municipal corporations' act restored to the inhabitants of towns those rights of self-government of which they had been deprived since the 14th century. The year 1836 saw the passing of an act giving dissenters the right to civil marriage, and 1839 the appointment of a Committee of the Privy Council on Education. But now the long results of all these movements towards social progress were to bear fruit in the application of the newly-discovered facts of science to measures of sanitary reform. The echoes of the warnings of Sir John Pringle regarding the preventable evils under which the troops had suffered in Flanders in 1742, and of the unnecessary mortality from gaol-fever, given in 1750, had long since died away; and though it had been shown that scurvy had been prevented on the ship "Resolution" which sailed round the world under Captain Cook, by the use of fruits, and even though Lavoisier had spent weeks in studying the pestilential air of the great sewers of Paris, yet the fatalistic belief in disease as being a punishment of men for their sins, was too deep-seated to enable the isolated scientific facts regarding the preventability of disease to be in any great degree realized. But now the evils resulting from the congested populations of industrial centres were becoming so apparent, and the losses to industry through epidemics of typhus, smallpox and cholera to commerce so positive as to be no longer unnoticed by the growing altruism of a progressive nation. Child-labor, often paid for at a penny a day, had become a monstrous and crying evil; yet workmen were driven by poverty to send one after another of their children into factories, only in the end to beat down their own wages. Children of six and seven years of age often worked twelve hours a day in factories, where the atmosphere, physical and moral, was abominable, and children of both sexes were growing up in a commercial slavery. Agitation in Parliament caused a committee of enquiry to be appointed and eminent physicians pointed out that the system meant a mental, moral and physical degradation of the mass of the English people. In the

Reform Parliament of 1833, the good Lord Shaftesbury became the people's champion, and introduced a bill limiting child labor to nine years, while the manufacturer raised the cry that with such keen foreign competition English manufacturers must be ruined. Although the doctrine of *laissez faire* failed in some degree, since the ten-hour period was made applicable to children of thirteen and over, yet trade was not ruined, but flourished remarkably in succeeding years. The Government actuary had already made a statement before a Parliamentary committee that though the social conditions of the middle classes of England had improved, yet their expectation of life had not increased. The subject was brought to the attention of a young lawyer who was interested in such matters, and in 1828 he published a criticism of its conclusions which won the attention of leading social reformers and economists. The name, ever dear to sanitarians, of the lawyer, was Edwin Chadwick, who, as stated by his biographer, began the study merely as a question of statistics, but as the labor progressed, a new train of reasoning came into his mind, which he called the "sanitary idea"; that is to say, "the idea that a man could, by getting at first principles, and by arriving at causes which affect health, mould life altogether into its natural cast, and beat what hitherto had been accepted as fate, by getting behind fate itself and suppressing the forces which led up to it at their prime source." Other papers on "Preventive Police" and "Public Charities in France" followed, and Chadwick was greeted by old Jeremy Bentham, then in his eighty-second year, as a disciple of his creed that "the work of the legislator is to enable people to live happily." Chadwick, now seized with the sanitary idea, went slumming in East London and took typhus, and all but became one of the first martyrs to sanitation. He lived, however, to become Secretary of Lord Grey's Poor Law Commission in 1832, and in 1834 we find him installed as Permanent Secretary of the New Poor Law Board, having acted in 1833 on the Poor Law Commission, in whose report he succeeded in having inserted a clause dealing with the half-time system, by which those children only could be employed who could present tickets of having spent three hours daily in some school during the previous week. Though the Lords amended these proposals somewhat on the ground that they would lead insidiously to a system of universal national education, yet it was soon found that 60 per cent. of the destitute orphan children were going to Poor Law Schools; and it may be noted that this is the law in successful operation up to the present day in industrial schools in England. Of Chadwick's labors during the next five years, Lord John Russell, the father of so many of these Parliamentary reforms, said: "For the

relief of the destitute and prevention of pauperism, the improvement of the public health and the physical condition of the population, there was no one to whose zeal and assiduity the country is more indebted than to Mr. Chadwick." But his labors were to bear further fruit. The Dissenters had been urging that the State should undertake the registration of births, marriages and deaths, as well as allow marriages to be celebrated by dissenting ministers. Chadwick saw in this the opportunity to promote the first great principle of sanitary reform by having the causes of death tabulated, establishing thereby a basis for sanitary study and deduction; while the Government to be relieved of a political agitation, followed the lead of Lord Lyndhurst, and in 1836 passed the registration act in large measure as it now exists, and the year 1838 saw that distinguished man, Dr. William Farr, installed as Registrar-General. To the study of these returns for the last sixty years, everyone of us is prepared to say in the words of Dr. H. W. Richardson, the biographer of Chadwick: "The proverb that 'pestilence walketh in the dark' is no longer true: pestilence measured and registered, walketh at last in the open day."

We have already referred to the distress and discontent following the Napoleonic wars. These, however, were not all or the greatest of the evils. In 1816 typhus and relapsing fever appeared in the rookeries of London, and became epidemic throughout England. Relapsing fever disappeared in 1891, but typhus remained endemic, again becoming epidemic in 1826-7. The year 1826 saw another disease appear, then unknown, but in 1849 through the studies of Drs. Budd and Jenner, it had become known as typhoid. But evil followed evil; for the decade between 1830-40 saw Asiatic cholera advance from Russia to Germany and sweep over England in the epidemic of 1832-34; smallpox prevailed in 1836-39, and Russian influenza followed in successive waves in 1831-32. And with this decade, in which the emigration of the population grew in increasing numbers, we see America entering upon those years which were similarly to mark the beginning of State Medicine. Of the period prior to this, Dr. Bowditch, in his "Centennial Discourse" at Philadelphia in 1876, briefly writes: 'It is the epoch of systems of medicine wrought out by the imaginations of some few of the leaders of our profession. * * * This epoch believes in drugs, and their almost supreme power over art. It has little or no faith in Nature's ability to cure disease."

With the passing of Dr. Benjamin Rush in 1838, the greatest American physician of his day, this epoch of "Systems of Medicine," in which there was no belief in the *vis medicatrix naturae*, came to an end. The teachings of Louis, a preceptor of Bowditch, were now to

influence the medical ideas and practice of the rising generation, and to them Bowditch ascribes the "Basis of Public Hygiene" in America, developed principally by the writings of Bigelow and Bartlett, with Oliver Wendell Holmes.

But to return to England, the scene of the great sanitary agitation, which we have seen already as being well advanced, we find that the investigation by Chadwick into the condition favoring the epidemic spread of typhus in London was bearing abundant fruit. Bishop Bloomfield, then of London, realized the full significance of the facts set forth, and threw all his energy and powerful influence into Chadwick's grand sanitary design; and Lord John Russell, in 1839, instructed the Poor Law Commissioners "to institute what afterwards became the far-famed inquiry into the health of the laboring classes of the other parts of England and Wales beyond the metropolis"; which report prepared by Chadwick was presented to the Home Secretary in 1842. In the next year this indefatigable secretary prepared papers on "Graveyards of London" and "Intramural Interments and Disinterments," resulting in the compulsory establishment of cemeteries outside towns and cities. The cause was soon to find another champion in that noble man, the Prince Consort, the spokesman of our beloved Queen, whose glorious life-work is not yet completed. Through his great influence assisting the labors of more active reformers, Sir Robert Peel appointed a Royal Commission, consisting of such famous men as Professor Owen, Dr. Lyon Playfair, Mr. Robert Stephenson, Mr. Smith of Deanston, and Mr. William Cubitt, to report on the whole subject of the health of the nation. This report was published in 1844. Although no immediate legislative action followed, yet in 1847 another Commission with Chadwick as a member was appointed to enquire into the "Sanitary Condition of the Metropolis." The evidence of thirty-five witnesses therein set forth was most startling in its effects on the public mind. An immediate result was the formation in 1848 of the first Board of Health, of which Lord Shaftesbury and Mr. Chadwick were members. And it was none too soon, since a virulent outbreak of cholera appeared in 1849. It will thus be seen how the "Period of Agitation," together with our "Period of Investigation," employed the energies of the people of England for half a century. But the labors of the ever-increasing band of workers in the fields of pure science had been gaining in force and directness of aim. In 1831 there had assembled at York individuals and members of local scientific societies, and the British Association for the Advancement of Science was organized. In its annual reports, which now for seventy years have appeared, have been collected the labors of workers in every field of

science. Referring to the isolated position of workers in the field of science, the first President of the Association expressed a sentiment, yet to be repeated with much force, viz: "I do not think it is either politic or liberal to keep those who employ their rarest intellectual endowments in the direct service of the country upon a kind of parish allowance"; which was but saying again what Voltaire said of encyclopædist Diderot, who got but £120 for years for his work; "And then to think an army contractor makes £800 a day."

We now pass naturally into the formative period of public health which we may properly designate—

(3) *The Period of Legislation.* The formation of the first Board of Health for the metropolis served to meet the emergency caused by the outbreaks of typhus and cholera, which marked these years of great political agitation with their Chartist risings and Socialistic organizations, all growing out of the increasing sense of injury and injustice for which, in the popular mind, the rich were in some way responsible. The year 1845 of the potato famine in Ireland presents a picture of misery, the memory of which remains with many yet living, and which from the sanitary standpoint proved of extreme importance to this continent. In the year 1847 very many of the sufferers emigrated to the United States and Canada, and the horrors of a voyage, during a passage of many weeks, can now be realized only by a visit to the silent burial-grounds of the quarantine stations of the Atlantic sea-ports. During that fatal summer alone, 8,639 cases of ship-fever and 5,424 interments took place at Grosse Isle in the St. Lawrence, where a monument still stands to the memory of the devoted physicians who died at their posts, ministering to these unfortunates. From the ports the disease spread inland, and to-day the graveyards of many towns along the great inland waterways have numerous memorials of the years of the ship-fever; while the cholera of 1849 added still further to the horrors of the sea-voyage and to the dangers to the populations along the great immigrant routes of the St. Lawrence and the Erie Canal.

The first great measure of reform in England, arising out of this condition of affairs, was the abolition of the corn laws, described by Lord John Russell as the "blight of commerce, the bane of agriculture, the cause of bitter division among the classes, the cause of penury, fever and crime among the people." How the hopes of the people were lifted up, accompanied by the deep stirrings of the public conscience may be seen in the literary romances of the time of such writers as Canon Kingsley in his "Yeast," and "Alton Locke"; the one dealing with the conditions of the agricultural laborers and the other with employees of sweat-shops, and of Charles Dickens,

who in "Little Dorrit" and "Nicholas Nickleby," makes scathing attacks on the prison system and the Yorkshire proprietary schools. Such are but a few of the influences which gave momentum to the social reforms following financial reforms, the results of the work of Russell, Cobden and Bright. Political changes retarded somewhat the development of the public health measures, instituted by the "Health of Towns Act" of 1849, and of the first Board of Health, whose existence practically ended with the report of 1854, prepared by Chadwick, now Sir Edward. Its work was thereafter placed under the Local Government Board combined with the Poor Law Administration. Of this great sanitary reformer whose official work now came to an end, the political economist, John Stuart Mill, in writing to him said: "I need only mention the Sanitary Department, the importance of which, now so widely recognized, you were amongst the very first to press upon a careless public." Under this first Board of Health was appointed Dr. John Simon as the first Medical Officer of Health, and the City of London Reports, 1849-1854, supply us with the first series of public health reports in which the now every-day subjects of "House Drainage," "Public Water Supplies and Their Pollution," "Social Position of the Poor and Their Overcrowding," "Offensive Trades," "Smoke Nuisances," etc., are systematically dealt with. With the instincts of a general, Dr. Simon began in 1853 to prepare for the cholera, which again appeared in 1855, and he has given us, in the report of that year, not only a history of its progress but the first comprehensive summary of the sanitary conditions upon which the prevalence of cholera depends. I cannot forbear quoting a paragraph which illustrates how the facts developed in the fields of pure science had invaded the field of practical medicine. He says: "Thus then our position stands. Scientific prediction of phenomena can arise only in the knowledge of laws. That the phenomena of this disease, however capricious they may seem, are obedient to absolute uniformity as yet beyond our ken, are enchained by that same rigid sequence of cause and effect which is imposed on all remaining Nature, it would be impossible to doubt."

But with regard to larger views on public health, we have only to follow the subjects discussed by Dr. Simon in his five successive London Health Reports. In that of 1854 he especially deals with a subject of intense interest to many members of this Association, viz., the establishment of a Department of Public Health, presided over by a Minister of the Crown. He says: "But at least as regards its constituted head, sitting in Parliament, his department should be, in the widest sense, *to care for the physical necessities of human life.*"

Such separate department with its Minister of Health was not to be; nevertheless, the General Board of Health was continued, and we find Dr. Simon again in 1858 addressing the Right Honorable, the President of the Board, when making a report based upon the lectures of Dr. Greenhow, lecturer on Public Health in St. Thomas' Hospital, "On the Present Wasteful Expenditure of Human Life in England." Utilizing the Registrar-General's statistics of annual deaths during the twenty years since the registration act was passed, this paper deals with the causes of deaths, pointing out that "thousands of deaths annually result from diseases which are in the most absolute sense preventable," and goes on to point out in detail the different diseases included in this category. Successive annual reports presented new series of facts, each repeating with gathering strength the truths of preventive medicine; and we find that the proverb, *gutta cavat lapidem*, was here, as ever, true, for with the reappearance of cholera and typhus in 1865, public health measures were instituted, having a scope hitherto unknown. The Government ordered certain scientific researches to be undertaken; we find medical officers sent to the Continent to study these diseases in the seats of their prevalence, and special investigations instituted in those towns where these diseases had already appeared in England. Expert chemists, too, were engaged in studying the physiology of diseases in man, and now for almost the first time we find governmental intervention in the case of outbreaks of disease in animals. Of these, the most important was the investigation by Prof. Grainger into the causation of rinderpest, which caused enormous losses of cattle both in England and on the Continent. It is in the report of 1869 that we find Dr. Simon first referring to those discoveries which have shed undying glory upon the name of Pasteur. He says: "It will now be seen that the views indicated in Dr. (Burdon) Sanderson's report with regard to the agencies of morbid infection are the views of Schroder and M. Pasteur on the agencies of fermentation and putrefaction.

Throughout all this period of legislative progress there had been developing with increasing momentum the influence of those workers in pure science whose early labors have already been referred to in some detail. From time to time workers in the field of natural history had expressed views based upon variations in type through environment of both plants and animals; but not until the "Origin of Species" by Charles Darwin was published in 1859, had any scientific hypothesis capable of accounting for biological evolution been given to the public. In 1863, Thomas Henry Huxley published "Man's Place in Nature," and to these works must be credited much

of the growth of that method of thought which has been carried into every field of scientific research during the latter half of the century. To comprehend how the scientific imagination was directed into a hitherto untrodden field, we have to turn to the labors of a school of workers in France, soon to become famous through the discoveries mainly due to the labors of Pasteur, known to his countrymen, as to all others, as "*Le Grande Maitre.*" He may indeed, in the Carlylean sense, be called a "Poet of the Unseen." Following as a chemist the studies of Spallanzani and Gay-Lussac in the field of fermentation and putrefaction as applied especially to beer, he was soon attracted by Cagniard-Latour's and Schwann's experiments proving the relation of the yeast-cells present, to beer-fermentation, at a time when Helmholtz had seemingly been forced to again support Liebig's stoutly maintained oxygen theory. But in 1857 Pasteur had established the vitalistic theory beyond question, when he proved the presence of rod-like cells distinct from yeast-cells, by cultivating a new species of germ in sugar, present also in the souring of milk, wholly apart from albumenoid substances. It became his firm conviction that the fermentative process depended upon the life of the organisms present; and by the introduction of culture solutions gave us the first step in that science which we now term bacteriology. Following this came that other remarkable discovery that certain organisms, to which he gave the name *anaerobes*, were paralyzed by the presence of that very oxygen, which till now had been supposed to be the very essence of fermentative changes in organic substances; and soon proved that the real change was that of the fixation of oxygen during the growth of the bacteria themselves. But this germ theory had many battles to fight before it succeeded against the school of Liebig, especially prominent amongst whom was Pouchet, who taught an old doctrine of spontaneous generation. Not till the battle was renewed in England by Dr. Bastian as late as 1876, again to be driven out of court by the beautiful experiments of Tyndall on germless air, as shown by rays of light, was the germ theory of *omnis cellula a cellula*, or *omne vivum ex ovo*, to take its place as the discovery which has absolutely transformed medical and surgical practice during the last quarter of the century and given us a practical working basis for that isolation and disinfection in contagious diseases which has reduced the prevalence and mortality to an extent beyond the most sanguine dreams of the early apostles of the new doctrine.

Never was prophecy being more truly fulfilled than that of Pasteur: "*Il est au pouvoir de l'homme de faire disparaitre de la surface du globe*

les maladies parasitaires, si, comme c'est ma conviction, la doctrine de la generation spontanee est une chimere."

All will recall those experiments published first in 1877, when this savant, who, at first with such trepidation, trespassed on the field of Medicine—for, as he said, he was a chemist and neither a physician nor veterinarian—gave to the world practically all we to-day know regarding anthrax. As in the field of fermentation, others, as Pollender, Rayer and Davaine, and Robert Koch, had already discovered the rod-like bodies in anthrax blood; but it required the wizard touch of Pasteur to give life and meaning to their studies. Never has romance had more fascination than the story of how Pasteur not only proved the rod-forms to be the cause of the disease, but also showed that the slight difference in the blood temperatures of men, animals and fowls played a governing part in the propagation of the disease; and finally, as he showed in 1881, that by heat the virus could be attenuated until vaccine could be prepared for inoculation against the disease. In the words of his disciple and assistant, Roux, "Medicine had never before witnessed such perfection in experiments, such rigor in deduction, such certainty of application." His further work in the field of immunity, especially with regard to rabies, is now common knowledge; while millions of francs have been saved to France through inoculating animals with anthrax vaccine, and hundreds of human lives have been saved from death, through the vaccine against rabies. The establishment in Paris of the Pasteur Institute, that magnificent international monument to the genius of the "Great Master," has become for all of us an oft-told tale. Of him in the closing years of his life an intimate friend has written, after describing his personal appearance: "That is Pasteur as he appeared to me: a conqueror, who will some day become a legend, whose glory is as incalculable as the good he has accomplished."

(4) *Period of Elaboration and Development.* As will have been noted, Pasteur's first great discovery, that of the bacillus of anthrax in 1876, marks the beginning of the fourth quarter of the century, which we have designated the Period of Elaboration and Development. This is, too, the period which may be said to mark the beginning of what we call Listerism in surgery. It was at this time that Tyndall addressed a letter to Pasteur referring to renewed attacks on the germ theory and speaking of "the inattackable exactitude of your conclusions." It was, too, the year of the Centennial Exhibition in Philadelphia, and the holding of the first Public Health Congress in America, shortly to be followed by the outbreak of yellow fever in the valley of the Mississippi, which hastened the estab-

lishment of the National Board of Health—of brief but happy memory,—and which gave the impulse, owing to which health boards have been established, in almost every state or province in North America.

In the Republic of Mexico we also find that while a Supreme Board of Public Health had been formed as early as 1841, placing that republic in the first rank amongst us in recognizing the duty of the state to deal with public health as a national matter; yet, as pointed out by Dr. Orvañanos, it was not till that remarkable man, General Diaz, was made President in 1876 that this board was established on a permanent basis. Thenceforth the evolution of public health work in Mexico has been continuously directed by our confrère, Dr. Licéaga, whose labors during a quarter of a century for his country and for our science entitle him to a first place amongst the sanitarians of this continent, and indeed of the world. In no country that I am aware of does there exist to-day a more complete sanitary organization, or one in which the legislative, administrative and scientific functions are better coordinated or more efficiently carried out.

As the St. Lawrence gateway was that through which cholera was first brought to this continent in 1832, so to the Provinces of Canada belongs the honor of still earlier general health legislation. In 1833, the Legislature of the Province of Upper Canada passed an act entitled, "An act to establish boards of health and to guard against the introduction of malignant, contagious and infectious diseases in this Province, and for the formation of local boards of health." But as the emergency passed, so the Central Health authority was discontinued, and not till 1882 was the first Provincial Board of Health with permanent officers established in Canada.

In England the year 1875 marked the consolidation of public health laws and their extension to the formation of rural sanitary areas and the bringing of the country districts under the same legislation which had applied hitherto to towns.

While it has seemed well to confine this history of sanitary progress during the century especially to those countries of Europe where its first victories were won, yet it must not be forgotten that the needs of the population of the cities of this rapidly developing continent were not forgotten, though, as appears from Dr. Bowditch's paper in 1876, only in eight of forty-eight states had state legislation dealt seriously with public health matters.

Since then, as illustrated in Dr. Abbott's admirable summary of the public health progress in the United States during the century, what a change is apparent! To-day in this Association we find

representatives of state organizations from almost every state and province from the Tropics to the Arctic Circle. The three national governments of the United States, Mexico and Canada lend dignity to our councils through their official representatives; and what may be termed a system of Continental Health Observatories is reporting weekly the epidemiological conditions which affect 90,000,000 people. National quarantine services co-operate with state boards in protecting seaboards of 5,000 miles in extent against foreign invasion of disease, and many thousands of local boards of health are constantly engaged in the routine task of improving local sanitary conditions and suppressing outbreaks of those communicable diseases which formerly spread uncontrolled as epidemics. Thousands of cities, towns and villages, by public waterworks, have caused typhoid fever to become one of the least prevalent diseases, while cholera and yellow fever are rapidly becoming only a memory.

In the field of animal diseases, progress on this continent during this period of development has been yet more remarkable. Especially have we seen in the Bureau of Animal Industry of the United States the development of the most extended application of science to a branch of sanitation, which the world has ever seen. That it has been due primarily rather to commercial than to health considerations need not lessen our admiration for a work whose progress has been intimately connected with one of the oldest and most active members of this Association. To me the history of this organization embodied in the labors of Dr. Salmon is one of the highest examples of the rare combination of scientific methods with executive administration which has ever been witnessed; and one can only conceive what the sanitary progress of the United States might have been had a similar bureau developed, as has the Imperial Health Institute in Germany, public health, in dealing with the diseases of mankind. I have dwelt already much too long, I fear, on the causes which have made the last twenty-five years the Golden Age of Public Health. Of the innumerable discoveries in the field of biology one need not speak, for are we not all in some degree a part of them? If Germany has its Koch and Lœffler, have we not our own Sternberg and Salmon and Sanarelli; if Haffkine, Kitasato, Roux and Manson have shed glory in our science in eastern lands through their discoveries, so have Welch, Osler and Councilman lent lustre to experimental medicine on our own continent! In the field of the practical application of science during these twenty-five years on this continent, we may reply in the slightly altered motto of one of your States: "Si quaeris agrum amoenum, circumspice"—"If you seek a pleasing prospect, look around you." For the century which is ending the

task is accomplished. Said Prof. Tyndall in 1876, "Science desires not isolation, but freely combines with every effort towards the bettering of man's estate. Single-handed, and supported not by outward sympathy but by inward force, it has built almost one great wing of the many-mansioned home which man in his totality demands."

But to the thoughtful observer of society, as we find it to-day, with its strife between capital and labor as an unsolved problem, recalling a merciless industrial competition still making many of our people as galley-slaves, living under unsanitary conditions which are our shame, and existing on husks while our granaries are bursting with corn, the dealings of Providence must appear, as they did to Job of old, very incomprehensible. With Carlyle, such an one is forced to say, "Did I not believe that an intelligence is at the heart of things, my life on earth must be intolerable." But for us with the history of the passing century before us, surely there is room for encouragement. Browning, the poet of Optimism, and a sincere believer in Evolution, insists on the love of the Creator being immanent and operative in human life, and in spite of the woes and sorrows of mankind, as ever carrying him upward nearer to the moral ideal. As he says in Paracelsus:

> "And, man produced, all has its end thus far:
> But, in completed man begins anew
> A tendency to God."

For us as scientific workers, who have been students of the world-processes in the aeons which caused, as Tennyson calls it, "This fine old world of ours," to rise out of chaos, it ought not to be difficult to take courage from what we have seen this century to have accomplished in the field of our own science, even though it be but a stone in the edifice. Shall we not enter upon the work of another century with perfect faith as to the ultimate results? trusting in the words of Tennyson:

> "O yet we trust that somewhat good
> Will be the final goal of ill,
> To pangs of nature, sins of will,
> Defects of doubt and taints of blood;
>
> That nothing walks with aimless feet;
> That not one life shall be destroyed,
> Or cast as rubbish to the void
> When God hath made the pile complete."

REPORT OF COMMITTEE ON THE ETIOLOGY OF YELLOW FEVER.

By Dr. HENRY B. HORLBECK, Chairman,
Health Officer, Charleston, South Carolina.

To the President and Members of the American Public Health Association—Gentlemen: The Committee of the American Public Health Association, to whom has been entrusted the subject of the Etiology of Yellow Fever, beg to make their report, as follows:

Our report presented at the last meeting of your body at Minneapolis gave you a resumé of the investigations of several bacteriologists as to the status of the bacillus icteroides as presented to the scientific world by Prof. Guiseppe Sanarelli—as the cause of yellow fever.

There have been no other claimants that we are cognizant with during the year 1900, as to the discovery of the specific cause of yellow fever.

It will be, therefore, our effort to present to you the result of the labors of those bacteriologists who have, during the past twelve months, been devoting themselves to the study of Prof. Sanarelli's bacillus. The controversy as to whether this bacillus is the true cause of yellow fever continues to engage the attention of an extended circle who are taking the deepest interest in these investigations. This is a subject of vast importance to many millions of people who inhabit and live in tropical and semi-tropical regions where the possibilities of harm to human life from this cause is ever present. It is, therefore, surely a matter that will always command the profound attention of the many health officials whose responsibilities require their constant and undivided attention in taking the necessary precautions to protect the communities whose health interests are under their direct care and constant supervision.

During our heated spells of the midsummer months the boundaries of the possibilities of the prevalence of the scourge known as yellow fever are greatly extended, and for a limited period the greatest vigilance is expected and exacted in our more northerly ports—as is surely the case in our southern ports for a much longer time: to keep watch and ward to prevent the sickness and desolation that attends the presence of and the prevalence of typhus icteroides. Moreover sections where this plague has never appeared are deeply

concerned in their commercial relations with those places that may be suffering; so we may well realize a common, widespread and absorbing interest in the development of the knowledge of the causation of a disease that affects the health and well being of so extended a territory; inhabited by so many millions of human beings.

Tens of thousands of inhabitants in many lands in different continents have fallen victims to yellow fever, and we are still in ignorance of the causes of the disease. Constant and laborious have been the efforts made to unravel the labyrinth, but so far the secret seems still securely locked up, and it is still one of the mysteries of our profession that baffles the most painstaking and zealous investigators.

This Association stands on the record as having made the greatest efforts to induce a permanent organization to be established in a yellow fever port or centre for the purpose of continuous investigation. An organization of competent bacteriologists fully equipped to do work in this cause and to work until the mysteries of the etiology of yellow fever have been solved.

Our Congress has paid but scant attention to our recommendations and requests, and our immense interests of life and commercial prosperity are now, as they have been in the past, and non-intercourse and detention is exacted, hampering the vast requirements of modern progress.

The United States have been greatly favored during the year 1900. We have only the reports of a very few cases to note—the disease ceasing with those cases.

Yellow fever has been prevalent to a considerable extent in the Island of Cuba, especially in the city of Havana. Yellow fever has also prevailed to a limited extent on the coast of Mexico—also in Columbia and Brazil. I note 623 deaths at Sorocaba, in Brazil; also 95 deaths at Santos, and 55 deaths at Rio Janerio. The disease has not visited our shores and we have been greatly blessed.

The investigations as to the etiology of yellow fever are of a deep and abiding interest, on account of the distinguished character of the bacteriologists who have been pursuing the subject, and on account of the directly different results obtained.

As our report presented to you last year showed the most marked differences in deductions from investigations made, so in this past year there is a direct difference of opinion as to the Sanarelli bacillus in its relation to yellow fever.

I am indebted to our distinguished ex-President, Surgeon-General G. M. Sternberg, for the literature of several investigations and researches, as to the etiology of yellow fever. The limits of this paper

will forbid our presenting in extenso all of the published matter in reference to this all absorbing subject:

"San Paulo, January 12, 1900.

"*Professor Perroncito, President of the Royal Academy of Medicine, of Turin:*

In response to your request I send you a resumé of the researches made by my institute in 1898, which has just been printed. You will see that, in perfect accord with all unprejudiced observers, I consider that the serum of Sanarelli has not shown any favorable effect upon the sick who have been treated by this method. It is, besides, well known that its preventive action has completely failed in many cases in which the experiment has been made. I will say further that in our experiments made with the bacillus isolated at San Carlos, and recognized by Sanarelli as genuine, the serum has not succeeded in protecting the animals experimented upon against the effects of inoculation. When the cultures of San Carlos are tried with the serum of Sanarelli they are agglutinated in the proportion of one to 4000 and even more. The bacillus does not develop in the pure serum but mixed with one or two parts of bouillon it no longer prevents abundant development—only the bacillus grows agglutinated at the bottom of the tube, producing long chains very similar to those of the bacillus of Yersin. You can easily repeat this experiment, which was made by one of my assistants.

It results from all this, as I have already stated to a representative of the company manufacturing the serum, that this serum has neither bactericidal nor antitoxic power for the bacillus used in producing it, and that its employment should not be recommended.

As regards the etiological rôle of the bacillus which was discovered and very well studied by Professor Sanarelli, it seems to me that it is not entirely beyond doubt. Many epidemiological facts accord very badly with the bacillary theory. The bacillus has never been found in an evident manner in the fresh tissues of sixty yellow fever cadavers which I have examined with the best staining methods. The blood, which is always sterile in the first part of the malady, rarely gives a frank agglutination. The bacillus cannot be found by known methods of research in more than half the cases. When it is present it is only obtained in rare colonies, the disease being characterized by the facility with which the organism is invaded by microbes which have nothing to do with the malady. It is possible that the presence of Sanarelli's bacillus is simply due to a secondary infection, which varies in frequency according to the season and locality at which the observation is made.

I have seen in the literature references to observers who found the bacillus in all cases, and who believe they are able to make the diagnosis by the agglutinating action of the blood. But I am absolutely certain that their reports are the result of confusion and gross errors. If we admitted that the bacillus of Sanarelli is the cause of yellow fever there remains still much obscurity upon the transmission and mechanism of the malady; and certainly therapeutics has

as yet gained nothing from this discovery. The prevention of the disease continues to be one of the most difficult tasks.

As corresponding member of the Academy of Medicine of Turin, I feel myself obliged to make these declarations, as I have already done in my capacity as Director of the Bacteriological Institute, where the study of yellow fever has been carried on with much care during long years. Personally, I have seen more than 500 cases and about 100 autopsies, so that I am quite familiar with the malady. I have also visited twenty independent epidemic centres of the disease. If I have not published more upon this question it is because in my opinion it is still so far from being elucidated that it cannot be profitably discussed.

I terminate my letter with best wishes for the Academy and its members.

Very truly yours,
(Signed) Dr. Adolphe Lutz."

Dr. Sternberg, in an article published in The Medical News, December 9, 1899, says, after reviewing his expressed views as to the Sanarelli bacillus:

"For the present I see no good reason for changing the opinion expressed at the conclusion of my previous communication, viz., that the etiological relation of Sanarelli's bacillus has not yet been established."

Dr. Sternberg also calls attention to the following:

"Agramonte reports that he has isolated the Sanarelli bacillus from three cadavers in which death was not due to yellow fever."

Dr. Sternberg also, in his article, quotes the conclusions of Drs. Reed and Carroll, as follows:

"The conclusions of Reed and Carroll are stated as follows:

1. Bacillus X (Sternberg) belongs to the colon group.

2. Bacillus icteroides (Sanarelli) is a member of the hog-cholera group.

3. The various channels of infection, the duration of the disease and the gross and microscopical lesions in mice, guinea-pigs and rabbits are the same for the bacillus icteroides and the hog-cholera bacillus.

4. The clinical symptoms and the lesions seen in dogs inoculated intravenously with bacillus icteroides, are reproduced in these animals by infection with the hog-cholera bacillus.

5. Bacillus icteroides when fed to the domestic pig causes fatal infection accompanied by diphtheritic, necrotic and ulcerative lesions in the digestive tract, such as are seen in hogs when infected with the hog-cholera bacillus.

6. This disease may be acquired by exposing swine in pens already infected with bacillus icteroides, or by feeding them with the viscera of infected pigs.

7. Guinea-pigs may be immunized with sterilized cultures of bacillus icteroides against a fatal dose of the hog-cholera bacillus, and vice versa.

8. Rabbits may be rendered immune by gradually increasing doses of a living culture of bacillus icteroides of weak virulence against a fatal dose of a virulent culture of the hog-cholera bacillus.

9. The sera of animals immunized with bacillus icteroides and the hog-cholera bacillus, show a marked reciprocal agglutinative reaction.

10. While the blood of yellow fever practically does not exercise an agglutinative reaction upon bacillus icteroides, the blood of hog-cholera agglutinates this bacillus in a more marked degree, thus pointing, we think, to the closer etiological relationship of this bacillus to hog-cholera than to yellow fever."

In an able and interesting article in the Medical News, February 10-17, Dr. Aristides Agramonte, Acting Assistant Surgeon, U. S. A., gives a report of bacteriological investigations upon yellow fever, with the following conclusions:

"1. The specific pathogenic micro-organism of yellow fever is as yet an unknown entity in spite of the work reported by various observers; apparently, new methods of cultivation must be initiated or new culture media devised in future research.

2. The bacillus icteroides of Sanarelli, lately (1897), asserted to be the causative agent of yellow fever, is no more concerned in the production of this disease than the common colon bacilli which are constantly found in the blood and viscera of individuals suffering or dead from yellow fever.

3. When approved bacteriological methods are employed, the bacillus of Sanarelli does not, as a rule, appear in cultures from the blood of yellow fever patients.

4. Bacillus icteroides may be and has been found present in the tissues of cadavers dead from other diseases, neither allied nor similar to yellow fever.

5. The bacillus of Sanarelli, when subjected to agglutination tests, is not affected by the serum of yellow fever patients or convalescents.

6. The serum of convalescent yellow fever cases affords absolutely no protection against infection by the bacillus of Sanarelli.

7. None of the organisms thus far isolated from yellow fever cases can be considered as the pathogenic agent of the disease.

8. Experimental evidence has demonstrated that the serum of individuals convalescing from yellow fever, or who lately suffered an attack of this disease, will very materially and favorably affect those actually under the influence of the infection if injected under the skin,

on or before the fourth day after the invasion; but that it requires further study to determine the protective power of different sera and the dosage.

9. From the experimental evidence above referred to, we are led to believe that the subcutaneous injection of convalescents' serum will convey immunity to individuals whom we to-day consider as susceptible to the disease."

From the Public Health Reports of the United States Marine Hospital Service, September 7, 1900, we take the following conclusions from an article by Proust and Wurtz read before the International Congress of Hygiene and Demography translated by M. J. Rosenau, Passed Assistant Surgeon, U. S. M. H. S.

CONCLUSIONS.

"I. The bacillus icteroides, discovered by Sanarelli, seems to us to be the specific agent of yellow fever.

That micro-organism injected into certain animals, especially dogs, reproduces symptoms and lesions strikingly analogous to those observed in man.

The toxin of this bacillus produces in animals the same effect as the microbe. The injection of this toxin into five individuals reproduced in man typical yellow fever, accompanied by its symptoms and anatomical lesions.

The serum of individuals attacked with yellow fever agglutinates cultures of the bacillus icteroides.

II. The bacillus has a prolonged vitality both in air and water (fresh and sea). It is certain that it is the same in the soil. Moulds favor its development. These facts confirm conditions that have been known a long time. They explain the reawakening of yellow fever a long time after the extinction of an epidemic, and the longevity of the disease aboard vessels in bad hygienic conditions.

No new prophylactic measures have come out in this knowledge of the etiology of the disease. As formerly, the prevention of yellow fever consists in applying the measures of isolation and of disinfection, and of improving the hygienic conditions."

We have, as above, brought to your attention and consideration the findings and publications of these distinguished bacteriologists as to the specific cause of yellow fever.

They are very important contributions, however widely divergent, and while the matter of the etiology of yellow fever is far from being conclusively decided, these researches all of them furnish matters of information which will be guiding stars in future investigations.

NINTH REPORT ON THE YELLOW FEVER ON THE COAST OF THE MEXICAN GULF, BEING FROM THE 22D TO THE 26TH OF OCTOBER, 1900.

By Dr. EDUARDO LICÉAGA,

President Superior Board of Health, Mexico, Mex.

In fulfillment of the engagement which I have contracted with this Association, I now have the honor to present a summary of the cases of yellow fever which have been observed on the Gulf Coast of the Mexican Republic, and of the few which have appeared in the Port of Salina Cruz, the only one of the Pacific in which that disease has presented itself.

In order to take up the time of my hearers as little as possible, I have formed a diagram which represents the number of cases of this disease which have come to the knowledge of the Superior Board of Health, as well as of the deaths that have taken place.

In Veracruz, Orizaba and Cordoba, we have been able to get reports of almost all the cases, but in those small towns in which the fever is not endemic and where the sanitary service is not as yet well organized, precisely because the disease rarely appears, no reliable reports are made, either because the cases are not well authenticated, because there is a doubt as to whether the patients are suffering from yellow fever or from the bilious fever which is so prevalent in hot countries, or sometimes because, through the slight degree of culture on the part of the inhabitants, they ignore the advantages of isolation, and hide the facts so that the patients may not be taken to the lazarettes and separated from their families. For these reasons we have no complete knowledge of the cases of yellow fever.

The same thing does not happen with fatal cases, because in this country a body cannot be buried without the permission of the Registry Office, and the statistics of mortality are taken from that office.

In previous reports I have treated of the etiology of yellow fever, for which reason I do not consider it necessary to take up your time with that question; but I desire to inform the Association with regard to the measures that have been taken to prevent the spread of the disease along our coasts.

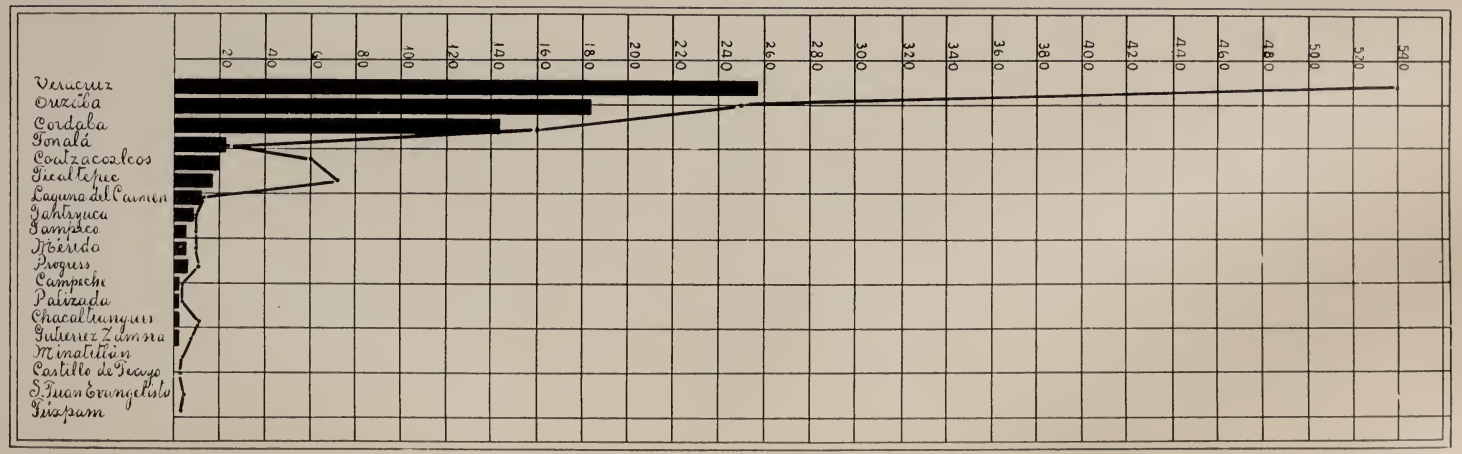
The States of the Mexican Union are independent in their legislation and administration; but in the interest of public health, they have been induced to create a real Sanitary Federation.

Yellow Fever

Number of cases and deaths that have occurred in the Mexican Republic; from the 15th September 1899 to the 16th September 1900

Cases ——·——
Deaths ■■■■

Notes - The disease that appeared in Orizaba under an epidemic form I consider was yellow fever
The number of deaths that occurred in each town is correct but the same cannot be said of the number of cases, as they are not all reported until they have a fatal termination.



The States of Tamaulipas, Veracruz, Oaxaca, Chiapas and Tabasco have shown a very decided zeal in bringing their sanitary regulations in line with those of the Federation, and their political and municipal authorities have placed themselves in communication with the Superior Board of Health, so as to give uniformity to the sanitary measures which they may adopt.

Last year I announced in the meeting of this Association, that a disease had appeared in Orizaba, assuming an epidemic character. A certain number of physicians of that locality have been of the opinion that the epidemic was of paludic origin, malaria, but that it bore the characteristics of yellow fever. The greater part of the physicians of Orizaba and others of Veracruz, who have a perfect knowledge of the disease, declared it to be yellow fever. This is my own conviction, founded on the studies of pathological anatomy made by distinguished specialists of Mexico City on the clinical aspect of the disease, and on the fact that it was developed at the same time as the epidemic of yellow fever which was prevalent in the neighboring town of Cordoba, where the epidemic assumed a greater degree of intensity than in previous years in Veracruz, and at the same time spread, although on a smaller scale, to Merida, Progreso, Campeche, San Juan Bautista, Tuxpan, Tampico, etc. It would be rather an extraordinary thing for the disease which simultaneously appeared in those localities to be yellow fever, and the Orizaba epidemic to be only a paludic fever. If to this we add the opinions of the physicians above mentioned, who have had an extended experience of the disease in places in which it is epidemic, you will understand how I come to be convinced that the epidemic in Orizaba was really yellow fever.

Under these circumstances, and in order to exterminate the disease in Orizaba, the Government of the State of Veracruz and the Board of Health appointed a sanitary agent to overlook the carrying out of the measures, which resulted in an improved sanitation of that ward of the city which had been the scene of the devastation caused by the epidemic. A swamp was drained; the sheds and huts which had been the focus of the epidemic were destroyed; the dwellings of those who had suffered from the disease were disinfected; the rubbish was burned, the streets were swept and watered with greater frequency, and many other measures were taken, the result of which has been that during the present summer, and when the yellow fever has again appeared in Veracruz and other localities, not a single case has been observed in Orizaba.

The Port of Veracruz is already commencing its sanitary work; that of Tampico will very soon do the same thing, and the example

will be followed by other towns which have at times suffered from epidemics of this character.

The measures adopted by the towns in the States above mentioned have brought about a notable reduction in the number of cases of attack, as can be seen from the diagram I present with this report. The lines representing the mortality in Cordoba and Orizaba, refer to the past year and not to this; whilst even in Veracruz the epidemic of this year has not been as severe as that of the previous year. It is to be hoped that the sanitation of the towns, the isolation of the first cases of the disease, and the disinfection of the articles contaminated by the patients, will bring about the disappearance of the spontaneous cases that now present themselves in those places in which the epidemic prevails, in like manner and with the same efficacy, as the Maritime Sanitary Regulations have prevented the importation of yellow fever.

Mexico, October 15, 1900.

THE ETIOLOGY OF YELLOW FEVER.—A PRELIMINARY NOTE.

By WALTER REED, M. D., Surgeon, U. S. A.;
JAMES CARROLL, M. D.; A. AGRAMONTE, M. D., and
JESSE W. LAZEAR, M. D.,[1]
Acting Assistant Surgeon, U. S. A.

The writers, constituting a board of medical officers convened "for the purpose of pursuing scientific investigations with reference to the acute infectious diseases prevalent on the Island of Cuba," arrived at our station, Columbia Barracks, Quemados, Cuba, on June 25th of the present year, and proceeded, under written instructions from the Surgeon General of the Army, to "give special attention to questions relating to the etiology and prevention of yellow fever."

Two of its members (Agramonte and Lazear) were stationed on the Island of Cuba, the former in Havana, and the latter at Columbia Barracks, and were already pursuing investigations relating to the etiology of this disease.

Fortunately for the purposes of this board, an epidemic of yellow fever was prevailing in the adjacent town of Quemados, Cuba, at the time of our arrival; thus furnishing us an opportunity for clinical observations and for bacteriological and pathological work. The results already obtained, we believe, warrant the publication at this time, of a preliminary note. A more detailed account of our observations will be submitted to Surgeon General Sternberg in a future report.

The first part of this preliminary note will deal with the results of blood cultures during life and of cultures taken from yellow fever cadavers; reserving for the second part a consideration of the mosquito as instrumental in the propagation of yellow fever; with observations based on the biting of non-immune human beings by mosquitoes which had fed on patients sick with yellow fever, at various intervals prior to the biting.

In prosecuting the first part of our work, we isolated a variety of bacteria, but of these we do not propose to speak at present. It will

[1] Died of yellow fever at Columbia Barracks, Cuba, Sept. 25, 1900.

suffice for our purpose if we state the results as regards the finding of *bacillus icteroides*, leaving the mention of other bacteria to our detailed report.

The cases studied during the Quemados epidemic had been diagnosed by a board of physicians, selected largely by reason of their familiarity with yellow fever. This board consisted of Doctors Nicola Silverio, Manuel Herera, Eduardo Angles and Acting Assistant Surgeons Roger P. Ames and Jesse W. Lazear, U. S. Army.

Those studied in Havana were patients in Las Animas Hospital and had been diagnosed as such by a board of distinguished practitioners of that city.

An examination of Table I will show the character of the attacks.

The milder cases studied, few in number, were attended by jaundice and albumen in the urine.

I.

Bacillus Icteroides (Sanarelli) as the Cause of Yellow Fever.

The claim of Sanarelli for the specific character of B. icteroides as the causative agent in yellow fever, has excited such wide attention, since the publication of his observations, that it seemed to us of the first importance to give our undivided attention to the isolation of this micro-organism from the blood of those sick with yellow fever and from the blood and organs of yellow fever cadavers.

(A) *Cultures Taken from the Blood During Life.*

The method followed was that ordinarily used in an attempt to isolate bacteria from the circulating blood; viz., from a vein at the bend of the elbow, a sufficient quantity of blood was taken with an hypodermic syringe, made sterile by boiling, and after careful cleansing of the skin with soap and water, followed by equal parts of absolute alcohol and ether, and 1-2000 bichloride solution.

Exceptionally, the blood withdrawn was plated on agar, but as a rule, it was immediately transferred to sterile bouillon tubes (10 c. cm.) in quantities of 0.5 c. cm. to each of several tubes. These were then incubated at 35° to 37° C. for a period of one week. They were examined daily and if growth was observed, plates in agar or gelatine, or both, were made and the colonies carefully studied by transference to ordinary laboratory media.

Eighteen cases have thus been carefully studied; of these, eleven were designated as "severe" cases of yellow fever with four deaths; three as "well-marked" cases with no deaths, and four as "mild" cases with no deaths.

From these eighteen cases, blood cultures were made, as shown in the following table:

TABLE I.

BLOOD CULTURES DURING LIFE.

Day of Disease.	Character of Attack.	No. of Cultures.	No. of Bouillon Tubes Inoculated.	B. Icteroides.
1st.	Severe.	3	4 (3 agar plates.)	Negative.
"	Well-marked.	1	4	"
"	Mild.	1	3	"
2nd.	Severe.	6	18	"
"	Well-marked.	1	2	"
"	Mild.	1	3 (6 agar plates.)	"
3rd.	Severe.	7	18 (6 agar plates.)	"
"	Mild.	2	4	"
4th.	Severe.	5	14	"
"	Well-marked.	2	6	"
"	Mild.	1	1	"
5th.	Severe.	5	12 (3 agar plates).	"
"	Well-marked.	1	3	"
"	Mild.	1	1	"
6th.	Severe.	4	6	"
"	Well-marked.	1	2	"
7th.	Severe.	1	2	"
"	Well-marked.	1	2	"
8th.	Severe.	2	6	"
"	Well-marked.	1	2	"
9th.	Severe.	1	2	"

Number of cultures..... 48
" " bouillon tubes inoculated..... 115
" " agar plates..... 15

It will be seen that of 48 separate cultures made from the blood on various days of the disease and representing 115 bouillon inoculations and 18 agar plates, we failed to find bacillus icteroides in any of our tubes or plates.

The results of cultures taken in 18[1] cases of unmistakable yellow fever, on various days of the disease and in some cases on every day from the onset to death or recovery, would seem to exclude the presence of bacillus icteroides in the blood of these cases during life.

It will, therefore, be seen that while Wasdin and Geddings taking cultures from the ear-lobe (Report on the Cause of Yellow Fever, 1899), record that "in the blood of yellow fever cases extracted during life bacillus icteroides has been found in thirteen of the fourteen cases, with one negative," (92.85 per cent.) we, by withdrawing blood from the veins of 18 patients, have to record 100 per cent. of failures.

[1] Cultures from the blood during life had been taken by Dr. Lazear in three other cases of yellow fever, but owing to the death of our colleague, the necessary data as to the day of the disease on which cultures had been taken cannot be ascertained.

These cultures were negative as regards the finding of Sanarelli's bacillus.

We have already stated that we will reserve for a later report a description of the bacteria isolated from the blood in these cases. We now remark that but few organisms were obtained and that, as a rule, our blood cultures gave no growth whatever.

(B) *Cultures from Yellow Fever Cadavers.*

We tried to obtain autopsies very soon after death and sometimes succeeded in doing so. Tubes containing about 10 c. cm. of flesh-peptone bouillon were generally used for the first inoculation direct from the blood and organs. As soon as the laboratory was reached, agar plates were made from these inoculated bouillon tubes, the former as well as the latter being then incubated at 35°-37° C. In nearly every case gelatine plates were, also, made from the recently inoculated bouillon tubes and kept at a temperature of 19°-20° C.

If colonies were found in the agar or gelatine plates, on the following days, the corresponding bouillon tubes were, also, plated on agar and gelatine. The bacteria thus found in our plates were carefully isolated and studied upon the usual nutritive media, so as to enable us to identify them, if possible. We will here content ourselves with giving the results as regards the presence of B. icteroides only.

TABLE II.

No. of Case.	Day of Disease.	Time of Autopsy.	Source of Culture.	B. Icteroides.
1	7th.	2 hours after death.	Blood, liver, spleen, kidney.	Neg'tive
2	6th.	13 hours after death.	Blood, liver, spleen, kidney.	"
3	4th.	8 hours after death.	Blood, liver, spleen, kidney.	"
4	8th.	4 hours after death.	Abdominal cavity, blood, liver, spleen, kidney, bile, duodenum.	"
5	4th.	4 hours after death.	Blood, liver, spleen, kidney, bile, duodenum.	"
6	6th.	6½ hours after death.	Abdominal cavity, blood, pericardial fluid, lung, spleen, kidney, liver, bile, duodenum.	"
7	6th.	50 minutes after death.	Blood, lung, liver, spleen, kidney, bile, jejunum.	"
8	6th.	½-hour after death.	Blood, lung, liver, spleen, kidney, urine, small intestine.	"
9	4th.	2 hours after death.	Liver, spleen, small intestine.	"
10	5th.	7 hours after death.	Liver, kidney, spleen, small intestine.	"
11	3rd.	½-hour after death.	Liver, kidney, spleen.	"

Our failure to isolate B. icteroides in these eleven autopsies of yellow fever patients was a result which we had not anticipated. One

of us (Agramonte) who, at Santiago, Cuba, during the epidemic of 1898, succeeded in finding B. icteroides in 33 per cent. of his autopsies, has been much surprised at the absence of this bacillus in cultures from cadavers sectioned in Havana, during the present year. In two of the eleven cases we had reason to believe that from the character of colonies seen in gelatine plates, we would be able to isolate B. icteroides. These colonies, however, when transferred to other media and carefully studied, did not prove to be this bacillus. We wonder whether other observers have occasionally relied upon the appearance of colonies in gelatine plates, without further study. We only mention this as a possible explanation of the large percentage of positive results recorded by some observers.

Portier, of New Orleans, La., only succeeded, however, in isolating B. icteroides in three out of fifty-one autopsies (Journal of American Medical Association, April 16, 1896).

Lutz (Revista D'Igiene e Sanita Publica, XI, No. 13, July, 1900, pp. 474-475), says as the result of his extensive observations on yellow fever that bacillus icteroides cannot be found by present laboratory methods in more than half of the cases of yellow fever, and that when present, the colonies are few in number.

It is possible that our future autopsies may give more favorable results as regards B. icteroides.

II.

The Mosquito as the Host of the Parasite of Yellow Fever.

Having failed to isolate B. icteroides either from the blood during life or from the blood and organs of cadavers, two courses of procedure in our further investigations appeared to be deserving of attention, viz., first, a careful study of the intestinal flora in yellow fever in comparison with the bacteria that we might isolate from the intestinal canal of healthy individuals, in this vicinity, or of those sick with other diseases; or, secondly, to give our attention to the theory of the propagation of yellow fever by means of the mosquito,—a theory first advanced and ingeniously discussed by Dr. Carlos J. Finlay, of Havana, in 1881, (Anales de la Real Academia, Vol. 18, 1881, pp. 147-169).

We were influenced to take up the second line of investigation by reason of the well known facts connected with the epidemiology of this disease and, of course, by the brilliant work of Ross and the Italian observers in connection with the theory of the propagation of malaria by the mosquito.

We were, also, much impressed by the valuable observations made at Orwood and Taylor, Miss., during the year 1898, by Surgeon

Henry R. Carter, U. S. Marine Hospital Service. A note on the interval between infecting and secondary cases of yellow fever, etc. (Reprint from New Orleans Medical Journal, May, 1900). We do not believe that sufficient importance has been accorded these painstaking and valuable data. We observe that the members of the yellow fever commission of the Liverpool School of Tropical Medicine, Drs. Durham and Meyers, to whom we had the pleasure of submitting Carter's observations, have been equally impressed by their importance (British Medical Journal, September 8, 1900, pp. 656-7).

The circumstances under which Carter worked were favorable for recording with considerable accuracy the interval between the time of arrival of infecting cases in isolated farm-houses and the occurrence of secondary cases in these houses. According to Carter "the period from the first (infecting) case to the first group of cases infected, at these houses, is generally from two to three weeks."

The houses having now become infected, susceptible individuals thereafter visiting the houses for a few hours, fall sick with the disease in the usual period of incubation one to seven days.

Other observations made by us since our arrival confirmed Carter's conclusions, thus pointing as it seemed to us to the presence of an intermediate host, such as the mosquito, which having taken the parasite into its stomach, soon after the entrance of the patient into the non-infected house, was able after a certain interval to reconvey the infecting agent to other individuals, thereby converting a non-infected house into an "infected" house. This interval would appear to be from nine to sixteen days (allowing for the period of incubation), which agrees fairly closely with the time required for the passage of the malarial parasite from the stomach of the mosquito to its salivary glands.

In view of the foregoing observations we concluded to test the theory of Finlay on human beings. According to this author's observation of numerous inoculations in 90 individuals, the application of one or two contaminated mosquitoes is not dangerous, but followed in about 18 per cent. by an attack of what he considers to be very benign yellow fever at the most.

We here desire to express our sincere thanks to Dr. Finlay, who accorded us a most courteous interview and has gladly placed at our disposal his several publications relating to yellow fever, during the past nineteen years; and also for ova of the species of mosquito with which he had made his several inoculations. An important observa-

tion to be here recorded is that, according to Finlay's statement, 30 days prior to our visit, these ova had been deposited by a female just at the edge of the water in a small basin, whose contents had been allowed to slightly evaporate; so that these ova were at the time of our visit entirely above contact with the water. Notwithstanding this long interval after deposition, they were promptly converted into the larval stage, after a short period, by raising the level of the water in the basin.

With the mosquitoes thus obtained we have been able to conduct our experiments. Specimens of this mosquito forwarded to Mr. L. O. Howard, Entomologist, Department of Agriculture, Washington, D. C., were kindly identified as *Culex fasciatus* Fabr.

In this Preliminary Note we have not space to refer, at length, to the various interesting and valuable contributions made by Finlay to the mosquito theory for the propagation of yellow fever. In addition to the paper already quoted, his most valuable contributions to this important theory are to be found in the articles designated as follows: Estadistica de las Inoculaciones con mosquitos contaminados, etc. Reprint, Havana, 1891: Fiebre Amarilla, Estudio Clinico Patologico y Etiologico. Reprint, Havana, 1895: and Yellow fever immunity,—Modes of Propagation: Mosquito theory, 8th Congress of International Hygiene and Demography, Budapest, 1894.

His present views on this subject may be stated in his own language: "First, reproduction of the disease, in a mild form, within five to twenty-five days after having applied contaminated mosquitoes to susceptible subjects. Second, partial or complete immunity against yellow fever obtained when even no pathogenous manifestation had followed those inoculations." (Medical Record, Vol. 55, No. 21, May 27, 1899.)

Without reviewing the cases regarded as mild forms by the author of this theory, we believe that he has not, as yet, succeeded in reproducing a well marked attack of yellow fever, within the usual period of incubation of the disease, attended by albumen and jaundice, and in which all other sources of infection could be excluded.

The experiments made by us on eleven non-immune individuals are embraced in the following table which should be carefully studied.

The mosquito used in all cases was *Culex fasciatus* Fabr.:

TABLE III.

INOCULATION OF NON-IMMUNE INDIVIDUALS THROUGH THE BITE OF MOSQUITOES (C. FASCIATED).

No. of Case.	Age.	Nativity.	Date of Inoculation.	Character of attack and No. of patients bitten.	Day of Disease.	Time of between infection of mosquito and inoculation.	No. of Mosquitoes.	Result.	Remarks.
1		U. S.	August 11th.	Mild.....1	7th.	5 days.	One.	Negative.	
2		U. S.	" 11th.	Very mild ..1	5th.	5 "	"	"	
3	24	U. S.	" 12th.	" ..1	5th.	6 "	"	"	
4	20	U. S.	" 12th.	" ..1	5th.	6 "	"	"	
5	24	U. S.	" 14th.	" ..1	5th.	8 "	"	"	
6	34	U. S.	" 16th.	" ..1	5th.	10 "	"	"	
7	22	U. S.	" 18th.	Severe.....1	2nd.	3 "	"	"	
8	20	U. S.	" 19th.	Very mild ..1	5th.	13 "	Two.	"	
				Severe.....1	1st.	3 "			
9	28	U. S.	" 25th.	Fatal. 1	2nd.	6 "	One.	"	
				Mild.....1	1st.	4 "			
				Severe.....1	2nd.	2 "			
10	46	England.	" 27th.	" 1	2nd.	12 "	One.	Positive.	Severe attack of yellow fever.
				Mild.....1	1st.	6 "			
				Severe.....1	2nd.	4 "			
				Mild.....1	2nd.	2 "			
11	24	U. S.	" 31st.	Fatal.....1	2nd.	12 "	One.	Positive.	Well marked attack of yellow fever.
				Mild.....2	2nd.	4 and 10 days.			
				Severe.....2	2nd and 9th.	2 and 8 "			
				" 3	1st, 2nd and 2nd.	2, 8 and 16 "	One.		
				Mild.....2	1st and 2nd.	6 and 10 "			
				Fatal.....1	2nd.	12 "	One.		
				Severe 1	1st.	2 "			
				Mild.....3	1st, 2nd and 2nd.	4, 6 and 10 "			
				Severe.....3	All on 1st.	2, 4 and 8 "	One.		
				Mild.....1	2nd.	6 "			

It will be seen that we record nine negative and two positive results. It is, we think, important to observe that of the nine failures to infect, the time elapsing between the biting of the mosquito and the inoculation of the healthy subject varied in 7 cases from 2 to 8 days (Nos. 1, 2, 3, 4, 5, 7 and 9) and in the remaining two from 10 to 13 days (Nos. 6 and 8).

Five individuals out of the nine who failed to show any result (Nos. 2, 3, 4, 5 and 6) were inoculated by mosquitoes that had bitten very mild cases of yellow fever on the fifth day of the disease, and one individual by a mosquito that had bitten a mild case of yellow fever on the seventh day of the disease. (This latter patient was discharged from hospital three days later.) To this fact may possibly be attributed the negative results. Of the remaining three negative cases (Nos. 7, 8 and 9), and which had been inoculated by mosquitoes that had bitten severe cases of the disease, the interval between the bite and the inoculation varied from 2 to 6 days.

In the two cases (Nos. 6 and 8) where the interval was respectively 10 and 13 days, the inoculations had been made with mosquitoes that had bitten very mild cases of yellow fever on the fifth day of the attack. No. 8 was also bitten by a mosquito which had been infected by a severe case of yellow fever 3 days before.

We refrain from commenting further at this time upon the nine negative cases, preferring to record the results obtained rather than to indulge in speculation.

Of the two cases which we have recorded as positive in Table III, we now propose to speak at greater length.

Case 10. Dr. James Carroll, Acting Assistant Surgeon, U. S. Army, a member of this board, was bitten at 2 p. m., August 27, 1900, by *Culex fasciatus.* This particular mosquito had bitten a *severe* case of yellow fever on the *second* day of the disease *12 days* before; a *mild* case of yellow fever, on the *first* day of the attack, *6 days* preceding; a *severe* case of yellow fever, on the *second* day of the attack, *4 days* before, a *mild* case of yellow fever, on the *second* day of attack, *2 days* before inoculation.

Dr. Carroll remained well until the afternoon of the 29th, when he states that he felt tired and for this reason, when on a visit to Las Animas Hospital, the same afternoon (29th), sometime between 4 and 6 p. m., after visiting a few patients, he left the wards and waited outside on the porch, while his companions remained in the wards.

August 30th. During the afternoon, although not feeling well, Dr. C. visited La Playa, distant about one and a half miles from Columbia Barracks, and took a sea-bath.

August 31st, A. M. Dr. C. realized that he was sick and that he had fever, although he refrained from taking his temperature, but did visit the laboratory, distant about one hundred and forty yards, for the purpose of examining his blood for the malarial parasite. The examination was negative. During the afternoon he was compelled to take to his bed. At 7 p. m. temperature

was 102° F. No headache nor backache; only a sense of great lassitude. Eyes injected and face suffused.

September 1st, 7 A. M. T. 102° F. Blood again carefully examined by Dr. Lazear with negative result. 11 a. m., T. 102°.

The case having been diagnosed as one of yellow fever, Dr. C. was at noon removed to the yellow fever wards.

9 p. m., T. 102.8°, pulse 90, 12 o'clock, midnight, T. 103.4°, pulse 84.

September 2d, 3 A. M. T. 103.6, pulse 80. A trace of *albumen* was now found in the urine. The subsequent history of the case was one of severe yellow fever. *Jaundice* appeared on September 3d.

The accompanying chart No. 1 contains all of the necessary data.

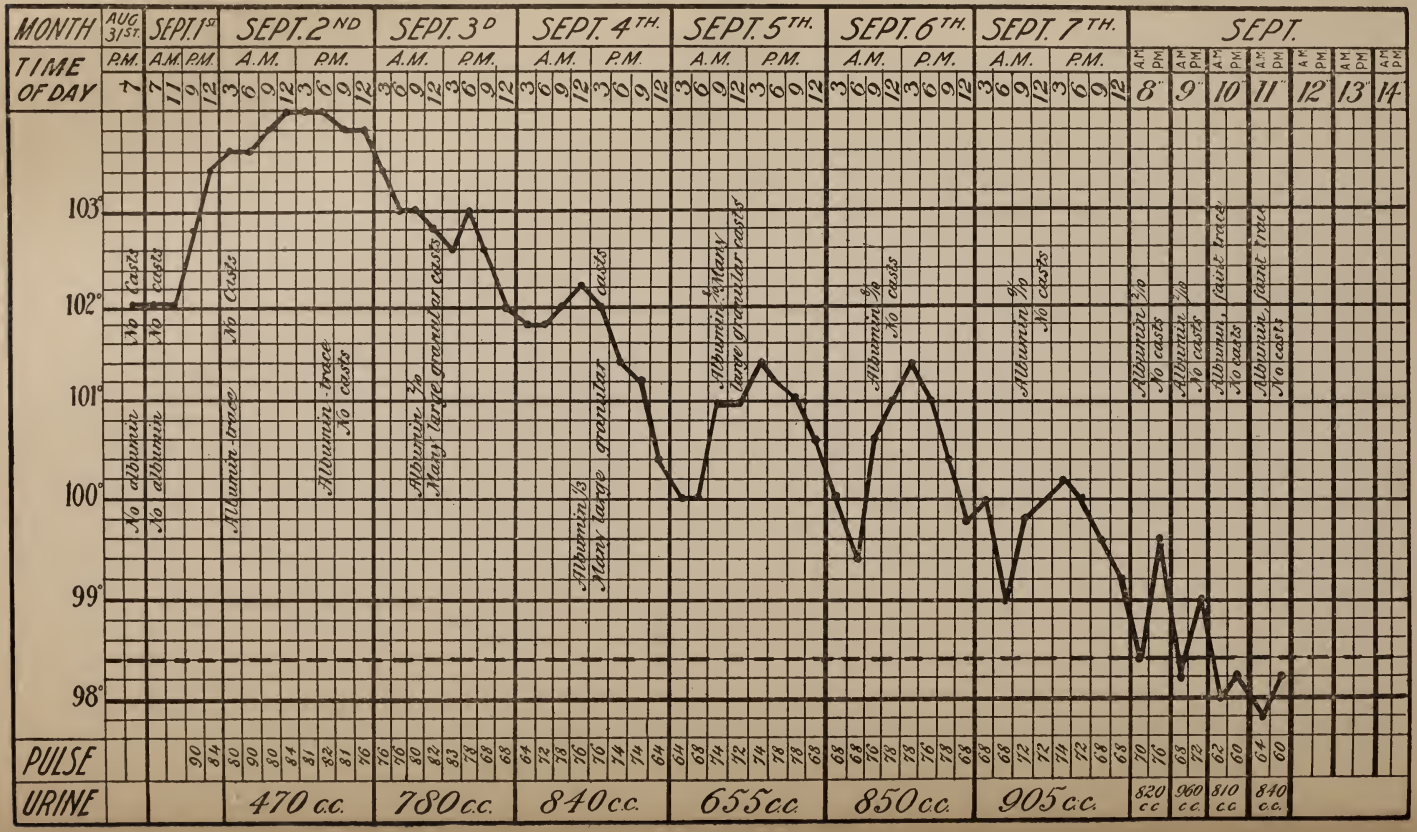
The question of diagnosis having been clearly and easily established, it now becomes important to follow Dr. C.'s movements for a period of ten days preceding the mosquito inoculation, and during the period elapsing from the bite of the insect until the commencement of the attack.

On August 21st, 22d and 23d, Dr. C. was at Columbia Barracks, outside of the epidemic zone. On August 24th he visited the autopsy-room of Military Hospital No. 1, which is situated on Principe hill overlooking the city of Havana. He was present in this autopsy-room while an autopsy was made by Dr. Agramonte on a case of pernicious malarial fever. Dr. C. only took cultures from the blood and organs as the section proceeded. He was there about half an hour and then returned to Columbia Barracks. Subsequent microscopic study of sections of the liver and spleen showed that the case autopsied on the 29th was really a case of pernicious malarial fever.

It should be stated that although cases of yellow fever are not admitted to Military Hospital No. 1, an English sea-captain had been admitted to its wards a few days before, whose case developed into one of yellow fever with fatal result, and the body had been autopsied by Dr. Agramonte in this dead-room on the day preceding Dr. C.'s visit to it.

According to Dr. C. the room was, by no means, in a cleanly condition. As Dr. C.'s visit to this room was made on August 24th, and as he began to complain on August 29th, about the average period of incubation of yellow fever, there is a possible chance for infection in this way. We must call attention, however, to the fact that Dr. Agramonte, whenever he performs an autopsy in this room, is always attended by a young soldier of the Hospital Corps, U. S. Army, who is detailed for that purpose, and whose duty it is to assist and to afterwards tend to the cleaning of the autopsy table. This soldier, a non-immune American, was present when Dr. Carroll was there and remained afterwards to attend to his duties. He has not contracted yellow fever by his duties in this room, from time to time.

Case I. Yellow fever following, within the usual period of incubation, the bite of an infected mosquito, (Culex fasciatus)



Our own experience would seem to accord with that of others, viz., that attendance upon autopsies and the handling of portions of organs of yellow fever cases removed to the laboratory is unattended with danger. Certainly the three non-immune members of this board, up to the time of these mosquito inoculations, had during the past three months come in close contact with the dead bodies and organs of yellow fever cases, freely handling and examining these organs, including the small intestine, even kept at thermostat temperature for 24 hours, without contracting the disease. We have, of course, never neglected to cleanse our hands with disinfectants.

Dr. C., upon his visit to the before-mentioned dead-room, only used the platinum loop for taking cultures and did not come in contact with the autopsy table.

The only other opportunity for infection in his case would appear to have been during his visit to Las Animas Hospital, situated in the suburbs of Havana, as here yellow fever patients are admitted in large numbers. We have already pointed out that Dr. C. was complaining of lassitude at the hour of his visit, which was about fifty hours after his inoculation with the contaminated mosquito. We have also called attention to the fact that he remained, for the greater part of his visit outside of the hospital, on the piazza. This would appear to cast doubt upon his visit to Las Animas as the source of his infection.

We do not wish to be understood as unnecessarily seeking to lay too much emphasis upon the exclusion in this case of other sources of infection than the mosquito, as we fully appreciate that Dr. C. had been, on two occasions, within the epidemic zone during the week preceding his attack of yellow fever. His movements on these occasions we have already given.

We will again refer to Dr. C.'s case, after we have given the history of Case No. 11, which we have designated as our second positive result.

Case II. X. Y., white, American, a resident of the military reservation of Columbia Barracks, was bitten during the forenoon of the 31st day of August, 1900, by the *same mosquito* that had bitten Case 10 (Dr. C.) four days before, and which in the meanwhile had bitten a *mild* case of yellow fever (first day) *two* days before being applied to X. Y.

X. Y. was, also, bitten by a second mosquito that had been applied to a fatal case of yellow fever (second day) 12 days before, and to two mild cases (second day) 4 and 10 days previously; also, by a third mosquito that had bitten a fatal case of yellow fever (second day) 12 days before; a severe case (first day) 2 days before and three mild cases (first, second and third day) 4, 6 and 10 days before finally by a fourth mosquito that had bitten three severe cases of yellow fever (all on the first day) 2, 4 and 8 days previously, and one mild case (second day) 6 days before. (Vid. Table III.)

It will thus be seen that X. Y. was bitten by *four* mosquitoes, *two* of which had bitten *severe* (*fatal*) cases of yellow fever *12 days previously;* one of which had bitten a *severe* case (*second day*) *16 days* before and one which had bitten a *severe* case (first day) *8 days* before.

September 25th, X. Y. began to experience a sense of dizziness and disinclination to work. This was just five days from the time of the mosquito inoculation.

Twenty-four hours later, still dizzy and light-headed in attempting to move about. During the afternoon (sixth day after inoculation), chilly sensations, followed by fever and restlessness during the night.

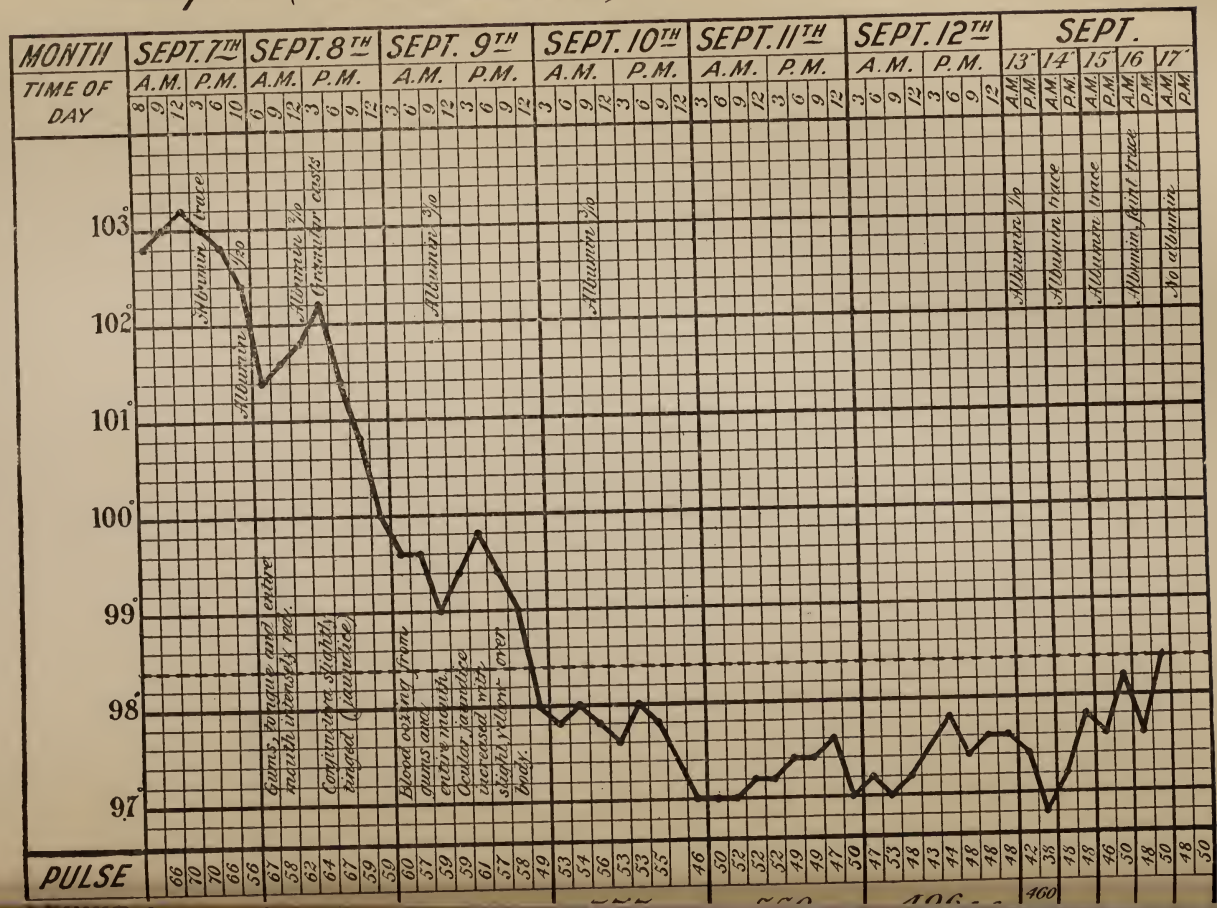
On the following day (seventh day after inoculation), 8 a. m., T. 102.8° F., eyes slightly injected, face suffused. Patient removed to the yellow fever wards; 9 a. m., T. 103° F., pulse 66. A trace of *albumen* was found in the urine during the afternoon (third day of the attack). This increased during the following days. Conjunctivæ slightly *jaundiced* on the fourth day of disease, which was more distinct and could be plainly seen on anterior aspect of chest on the fifth and following day. *Bleeding* from the gums was noticed on the third and subsequent days after admission. Repeated examinations of the blood failed to show any malarial parasites.

The course of the fever, the appearance of albumen in the urine, with jaundice and hemorrhage from the gums, together with the slow pulse, all pointed distinctly to the diagnosis of yellow fever. His attending physician, Dr. Roger P. Ames, U. S. A., an expert in the diagnosis and treatment of this disease, did not hesitate to diagnose X. Y.'s attack as one of "well pronounced yellow fever." Dr. A. was not cognizant of the method of inoculation in this case. (Vide, Chart II.)

The diagnosis, therefore, not being in doubt, we must follow this patient's movements during the ten days preceding the bite of the mosquitoes and from this time until five days later, when the attack began. It so happens that we can follow X. Y.'s movements for a much longer period. Fifty-seven days prior to his inoculation, he spent a day and night in the city of Havana. Sixteen days before the inoculation, he rode on horseback with six other non-immunes a distance of about one and a half miles towards the seashore and returned to his dwelling, without in the meantime dismounting from his horse. From this time until his complete convalescence was established, he had remained within the immediate vicinity of his home. So that it may be positively stated that X. Y. had not absented himself from the Military Reservation of Columbia Barracks during a period of fifty-seven days prior to his inoculation (with the exception above stated), nor between the date of his inoculation and the establishment of convalescence.

Let us now inquire whether the military reservation of Columbia Barracks is outside of the epidemic zone of yellow fever. To this we answer that since the commencement of the present epidemic

Chart II. Yellow fever following, within the usual period of incubation, the bite of an infected mosquito, (Culex fasciatus)



of yellow fever in Havana, dating from May, 1900, the average monthly population of this Station, including civilian employes, has been 1400, nearly all of whom are young non-immunes.

There have occurred amongst this non-immune population from May 1 to October 13, 1900, sixteen cases of yellow fever, all of which have been easily and readily traced to a visit to within the boundaries of the epidemic zone, except Cases 10 and 11 of Table III, and one other case of which we shall presently speak. These cases have been distributed as follows:

May 24th	1
June 10th	1
" 17th	1
" 19th	2
" 21st	1
" 29th	1
July 9th	1
" 26th	1
" 29th	1
August 11th	1
" 12th	1
" 16th	1
" 31st	1
Sept'r 7th	1
" 19th	1
Total	16 cases.

Ten of these cases have occurred amongst an average monthly military population of 1295 men, and six cases in an average civilian population of 105.

Whenever these cases have occurred, as soon as the patient has been removed to hospital most careful measures of disinfection have been immediately carried out by a trained sanitary squad, under the personal supervision of a medical officer. These have consisted of destruction by fire of mattresses, the disinfection of bedding and clothing with 1 to 500 bichloride solution, and the application of the same solution freely to the ceiling, walls and floors by means of a force pump.

We repeat that no case has ever been connected with a preceding case, but that the source of infection has been readily shown to have occurred during the individual's visit to Havana, 6 miles distant, or to some other nearer Cuban settlement.

We now invite attention to the fact that from August 17th to October 13th, a period of fifty-seven days, only three cases of yellow fever have occurred amongst this population of 1400 non-immune

Americans, and we consider it very important to note that *two of these had been bitten, within five days of the commencement of their attacks, by contaminated mosquitoes.*

Taken in connection with Case 11, in which we have been unable to find any other source of infection than the bite of an infected mosquito, five days preceding the attack, the case of Dr. C. (Case 10, Table III) becomes strongly confirmatory of the same origin.

We will now briefly give the history of the third case of yellow fever that has occurred at Columbia Barracks during the period August 17 to October 13, 1900.

In the light of Cases 10 and 11, we consider this case of sufficient importance to be here included, especially as it is one that might be possibly designated as a case of accidental infection by a mosquito.

Case. Dr. Jesse W. Lazear, Acting Assistant Surgeon, U. S. Army, a member of this board, was bitten on August 16, 1900, (Case 6, Table III), by a mosquito (*Culex fasciatus*) which ten days previously had been contaminated by biting a very mild case of yellow fever (fifth day). No appreciable disturbance of health followed this inoculation.

September 13, 1900, (forenoon), Dr. Lazear, while on a visit to Las Animas Hospital and while collecting blood from yellow fever patients for study, was bitten by a Culex mosquito (species undetermined). As Dr. L. had been previously bitten by a contaminated insect without after-effects, he deliberately allowed this particular mosquito, which had settled on the back of his hand, to remain until it had satisfied its hunger.

On the evening of September 18th, 5 days after the bite, Dr. L. complained of feeling "out of sorts," and had a chill at 8 p. m.

September 19th, 12 o'clock noon, T. 102.4°, pulse 112. Eyes injected, face suffused; 3 p. m., T. 103.4°, pulse 104; 6 p. m., T. 103.8°, pulse 106. *Albumen* appeared in the urine. *Jaundice* appeared on the third day. The subsequent history of this case was one of progressive and fatal yellow fever, the death of our much lamented colleague having occurred on the evening of September 25, 1900.

As Dr. L. was bitten by a mosquito while present in the wards of a yellow fever hospital, one must, at least, admit the possibility of this insect's contamination by a previous bite of a yellow fever patient. This case of accidental infection therefore cannot fail to be of interest, taken in connection with Cases 10 and 11.

For ourselves, we have been profoundly impressed with the mode of infection and with the results that followed the bite of the mosquito in these three cases. Our results would appear to throw new light on Carter's observations in Mississippi, as to the period required between the introduction of the first (infecting) case and the occurrence of secondary cases of yellow fever.

Since we here, for the first time, record a case in which a typical attack of yellow fever has followed the bite of an infected mosquito,

within the usual period of incubation of the disease, and in which other sources of infection can be excluded, we feel confident that the publication of these observations must excite renewed interest in the mosquito-theory of the propagation of yellow fever, as first proposed by Finlay.

From our study thus far of yellow fever, we draw the following conclusions:

1. *Bacillus icteroides (Sanarelli) stands in no causative relation to yellow fever, but, when present, should be considered as a secondary invader in this disease.*

2. *The mosquito serves as the intermediate host for the parasite of yellow fever.*

REPORT OF THE COMMITTEE ON STEAMSHIP AND STEAMBOAT SANITATION.

By FREDERICK MONTIZAMBERT, M. D.,

Director-General of Public Health, Ottawa, Can.

Mr. President, and Members of the Association—I shall have to ask the indulgence of the Association, and the other members of the Committee on Steamship and Steamboat Sanitation in particular, for not being able to submit a report of the committee at this time. When I authorized the Secretary of the Association to put my name on the program, I fully intended to make a report up to this time, but being away on an official visit to the Pacific Coast, and then rather unexpectedly called to an outbreak of smallpox in the Yukon Territory, which added several weeks to my absence, and greatly increased the amount of work I had on my return to Ottawa, I found it utterly impossible to make a report on this subject. I am glad, however, that one of the members of the committee, Dr. Doty, is on the program for a paper which is directly in line with this work.

NEW QUARANTINE METHODS AND CHANGES WHICH ARE CALLED FOR IN MARINE SANITATION.

By Dr. ALVAH H. DOTY,

Health Officer, Port of New York.

For some years past the conviction has been forced upon me that a careful review of the subject of public health, particularly that part of it which relates to marine sanitation, will show that many of the methods now employed in carrying out this important work are not in harmony with the facts which have been presented by scientific investigation and practical experience, and I believe the time has come when this matter should receive the most serious consideration. The term "commerce destroyer," which has been applied to coast quarantine, has not been used without some justification, inasmuch as such rigorous and unreasonable regulations have been imposed in different sections of the world that commercial intercourse with those sections has been almost abandoned. In the past, excuse may have existed for the enforcement of these measures, as but little was known concerning the cause of infectious disease, the germicidal value of agents known as disinfectants, etc. However, the brilliant researches of Pasteur and Koch twenty years ago, and the subsequent investigation of other savants, have given to the world indisputable evidence of the germ origin of many of the infectious diseases and have stimulated bacteriological inquiry in all directions. As a result, regarding this subject, we are now in possession of definite scientific knowledge which is in harmony with our practical experience. Therefore but little reason exists for the continuation of some of the methods at present employed in sanitation. If we profess a sanitary science we must abide by its teachings. In other words, we must have the courage of our convictions, no matter to what extent they may conflict with theory. Unfortunately the latter plays a prominent part in many of the quarantine regulations now in force, and while it adds nothing toward protecting the public health, it seriously injures commerce.

Contrary to the popular belief, the most careful investigation both from a scientific and a practical standpoint has demonstrated that the clothing actually worn by well persons is not a medium of infection. This is also true of ship's cargoes. In making this statement, I do not mean to imply that it is not within the bounds of possibility for exceptions to present themselves, but such instances are rare and should not be given undue weight in the consideration of this matter;

exceptions confront us many times in public health work. For instance, it is generally accepted throughout the world that the maximum period of incubation of smallpox is fourteen days, and it is for this period that persons who have been in contact with the disease are kept under observation by health officials. Reliable evidence, however, has occasionally been presented which tends to show that the appearance of smallpox may be delayed until the fifteenth or sixteenth day after exposure. Again, we accept five days as the maximum period of incubation of yellow fever, although instances are cited in which the disease has occurred after an incubation of six or seven days; still we are not justified in making rules and regulations to conform to these exceptions. In discussing this subject some time ago with a very distinguished health official, he emphatically endorsed the statement which I have just made regarding the clothing worn by well persons, and said that in his official experience covering a period of thirty-five years, he remembered but one case in which the clothing worn by a well person could have been regarded as the medium of infection. After an active experience of twenty years, I can bring to my mind but one instance of this kind. This occurred during the epidemic of typhus fever in 1893. I was not surprised, however, to find out subsequently that the man who had succumbed to the disease had been in direct contact with persons who at the time were suffering from typhus.

During the different epidemics of smallpox, typhus fever, etc., which have occurred in New York, the physicians, ambulance drivers, and helpers connected with the health department have been in close contact with the patients; the ambulance drivers being frequently obliged to carry the sick in their arms. Nevertheless no evidence that I am aware of, after a careful investigation, has ever been presented to show that infection was carried either to the homes of these officials or to their associates. Cases of smallpox, typhus fever, etc., are frequently found which have passed through the various stages of these diseases before detection. In many instances, the relatives of these patients, living in the same apartments with them, who by successful vaccination or otherwise have become immune, are employed in factories where they are in close contact with others, yet without transmitting the disease. The busy medical practitioner may during the day visit many cases of infectious disease and may go from them to others without previously changing his clothing or performing disinfection. He has reason to believe that he does not act as a medium of infection; he sees no evidence of it in his own home, nor is evidence presented to him that he transmits disease to his patients. If, under the circumstances which I have just cited, the clothing worn by well persons

does not act as a medium of infection, it is hardly reasonable to believe that danger exists in the clothing worn by those who are in good health and have been for a number of days or weeks removed from an infected port or other exposure. Bacteriological research goes far to confirm the results of practical experience to which I have just referred, inasmuch as it has shown that pathogenic organisms can continue their existence for only a few hours when exposed in the presence of sunlight and air. As a matter of fact, many careful observers believe that the activity, at least of some, of the specific organisms is inhibited by an exposure of only a few minutes to air and sunlight and that their activity and power of propagation are not renewed unless brought in contact with proper media. It is upon such evidence that we must base our conclusions in deciding what methods shall be employed to protect the public health.

As I have already stated, exceptions may exist, and occasionally evidence is presented to us from a reliable source which tends to show that disease is contracted through the medium of the clothing of well persons. It is reasonable to believe that when a person is in close and prolonged contact with a case of scarlet fever or smallpox, for instance, then puts on an outside wrap and removes it after going directly to another patient but a short distance away, he may transmit infection. However, careful investigation, and the most reliable evidence, shows that this occurs only in rare instances. In connection with municipal sanitation the possibility that such instances may occur should receive proper consideration, and reasonable efforts be made to prevent their occurrence, whereas in marine sanitation this possibility need receive consideration only when infectious diseases actually exist on the arrival of the vessel in port. It is not proper, nor does it aid in the advancement of sanitary science to overlook facts. The importance of a clear understanding of this matter, particularly in relation to marine sanitation, cannot be overestimated; it means, as a rule, that we can safely dispense with the disinfection of clothing actually worn by well persons arriving on vessels from infected ports; this not only lessens the detention of ships, but diminishes the expense to commerce. In municipal sanitary work this knowledge is valuable, as we are then reasonably assured that the disease will not spread—at least to any serious extent—through the medium of clothing worn by well persons; moreover, it teaches us to make a more thorough inspection in order to ascertain the origin of an outbreak of infectious disease. Such an inspection will frequently bring to light mild, ambulant, or convalscent cases which otherwise would not be found.

When we have given to the patient, his clothing and effects and apartment, the required attention, and have surrounded the case with

every possible sanitary precaution, and when at its termination we have performed careful and thorough disinfection, we have, I believe, given to the public the full protection which is dictated by practical science.

We have equally satisfactory evidence that a ship's cargo does not act as a medium of infection; if exceptions exist they have not been brought to my attention.

The outbreaks of bubonic plague in European and other ports with which the United States is in frequent and constant communication have brought prominently to our notice the question of the transmission of this disease by rats and other vermin. Our information on this subject is at present by no means complete; although Kitasato and Yersin demonstrated the presence of the disease in rats during the epidemic of bubonic plague in Hong Kong in 1894, we have beyond this but little authentic information on the subject. It is, however, reasonable to believe that in such communities as are found in India and China, where filth, overcrowding, and bad sanitary regulations exist to an extent which is almost beyond belief, the dissemination of infection is so general that even vermin are involved. However, in civilized communities where the ordinary sanitary regulations are carried out, the danger from this source would seem to be very limited. What may be a satisfactory summing up of this detail of the subject from a theoretical standpoint, although entitled to respectful consideration, should not overshadow the practical experience in this direction.

So far as I am able to ascertain, no authentic report exists which shows that cargoes of vessels have transmitted bubonic plague through the medium of infected rats or other sources. Since 1870 this disease has been particularly active in India and China and other eastern countries, where it has visited many important seaports. During this time both sailing-vessels and steamers have been plying between the ports referred to and the United States, carrying cargoes which come directly from the plague-infected districts, and which include raisins, rugs, silks, and other general merchandise. No quarantine restrictions whatever have been placed upon these cargoes, and in no instance has the disease been conveyed to this country. It would seem that a test of thirty years ought to be regarded as satisfactory evidence that bubonic plague is not likely to be transmitted in this manner, either by the cargoes or by the transportation of infected vermin. During the recent outbreak of the plague in Rio Janeiro and Santos, many vessels carrying coffee from these ports arrived at the New York Quarantine Station, probably two during each week, and for two months or more the cargoes

were removed in open stream and transferred to the city on lighters, an opportunity thus being given to collect such rats, dead or alive, as could be found on board. These were removed to the laboratory and examined bacteriologically, and in no instance was there the slightest evidence of bubonic-plague infection. During the past six years about thirty-five thousand vessels from different parts of the world have entered the port of New York, and while, save in seven or eight instances, their cargoes have in no way been disturbed, yet not the slightest evidence has been presented that this material has in any way transmitted any form of infectious disease. I may add to this the fact that the most careful investigation has failed to present satisfactory evidence that either foreign or domestic rags act as a medium of infection, although they include all kinds of wearing apparel which is frequently filthy and offensive. From what source, then, do we receive information which is supposed to give proof that the clothing worn by well persons or the cargoes of vessels act as a medium of infection? I believe it to be principally from vague reports, which have been handed down to us from almost ancient times. These reports, so far as my investigations are concerned, carry with them no scientific or practical proof, and are mainly hearsay evidence. For instance, an outbreak of infectious disease, the origin of which is unknown, appears at a small seacoast town. It is learned that a ship had previously arrived from an infected port, discharged its cargo, and departed; this appears to be a satisfactory explanation and it is decided that the disease was probably introduced by the cargo; but little or no attention is paid to the fact that on the arrival of the vessel the passengers and crew were not subjected to an examination, and that nothing is known of the possible existence of a mild case of infectious disease which may have remained in town or departed with the vessel. The license which theorists assume in dealing with this matter is apparently without any limit. Some time ago a foreign health official very gravely asserted that an outbreak of bubonic plague was caused by the transmission of infection through the medium of some neckties. Other statements are made regarding the origin of outbreaks of infectious disease which are equally ridiculous. No fair evidence is presented to substantiate such theories, which go far toward making public sanitation a farce. I believe that the future will show that if a vessel arrives in port and there are no cases of sickness present on arrival and none have occurred in transit, the vessel and its cargo will in no way act as a meance to the public health. From my own experience I am satisfied that this is true, and I believe that an outbreak of infectious disease when the cause is unknown is

almost always due to the presence of mild, ambulant, or convalescent cases which have passed unrecognized. These constitute a great danger to a community, inasmuch as there is no protection against them. Cases of smallpox occur in which the patient is apparently well and the eruption is with difficulty recognized. The frequent existence of mild cases of diphtheria is known to all physicians; mild or walking cases of typhoid fever which are mistaken for malaria, colds, etc., are well-known causes of serious outbreaks of this disease. The frequency with which mild cases of yellow fever occur is notorious; a vessel which arrived at this station some time ago from a port infected with this disease brought a large number of passengers, many of whom were not immunes; these were removed to Hoffman Island for observation and to complete the period of incubation; at the final examination all reported well, and from a visual inspection apparently were so. However, when the thermometers were used, four of the passengers were found to have elevated temperatures and were detained; of these, three were subsequently found to have yellow fever, one case being so mild that the patient could with little exertion have attended to his duties had he been allowed to proceed to his home. At least he could have kept up and around without arousing suspicion as to his condition. Cases of bubonic plague frequently assume a very mild form; of the four cases of this disease which occurred on the steamship "James W. Taylor," arriving at this port from Santos, Brazil, on November 18, 1899, one was fatal, and the body was buried at sea. On the arrival of the vessel at quarantine the facts connected with the death of the steward were reported. The remainder of the crew were assembled on deck, reported well, and, from external appearance, were so. Inasmuch as the vessel came from a plague-infected port and as the symptoms associated with the steward's death were suspicious, the crew were made to remove their clothing and were subjected to a careful inspection, including a glandular examination. At this inspection the characteristic local lesion and the glandular affection were found in three of the crew, and the diagnosis of bubonic plague was then made and afterward confirmed by bacteriological examination. The captain of the ship, who was one of the three members of the crew removed to Swinburne Island Hospital, stated that he felt bad only for a day or so while in transit, and was surprised when informed of the serious nature of the disease. It is possible for such a person arriving on a vessel from a port issuing a clean bill of health or believed to be free from quarantinable diseases, to pass an ordinary inspection, then proceed to some interior town,

there to act as a medium of infection without being recognized as such.

I believe the lessons which we are to learn from the facts which I have presented are that mild or ambulant cases of infectious disease and convalescents from these diseases constitute a serious menace to the public health and are chiefly responsible for outbreaks which from time to time occur, and which cannot be accounted for; and that neither scientific investigation nor practical experience justifies us in assuming that either the clothing worn by well persons or a ship's cargo acts as a medium of infection except in such rare instances as I have referred to. The views which I have thus expressed as the result of my scientific investigation and practical experience are in harmony with the policy which I pursue in the treatment of vessels arriving at the port of New York. I believe this to represent scientific sanitation; and while it offers the full protection which we can give to the public, it also relieves commerce of unnecessary delay and expense, a most important consideration.

In the inspection of persons coming from infected ports, it is evident that the ordinary examination, which includes statements from the persons concerned, is not sufficient at all times to detect mild or ambulant cases. It appears to me that the most practical and important addition that we can make to the ordinary method of inspection is the use of the clinical thermometer. This has been in operation at this station for the past two years, and the most satisfactory results have been obtained in detecting mild or ambulant cases. Although I am firmly convinced that the maximum period of incubation of yellow fever is five days, there is no doubt that during the first day or so of the disease, persons affected may present themselves and pass an ordinary inspection. The use of the thermometer at this time, however, will almost always show an elevation of temperature sufficiently high to justify us in causing a longer detention. The statements of persons detained at quarantine cannot be depended upon, and at this station we accept them only as corroborative evidence. Persons from yellow-fever infected ports, who are detained here to complete the period of incubation dating from the time of departure from the infected port, are never released until their temperatures have been taken. I have already cited one of the number of instances in which the disease has been detected in this manner. Passengers or crews coming from plague-infected ports are not released until their temperatures have been taken, no matter how long they have been in transit. These are instances of the value of the use of the thermometer at this station. It is frequently necessary to take the temperature of a thousand or more persons on

the arrival of a vessel here. Therefore I have constantly on hand forty or fifty first-class properly registered instruments. If these are unreliable, or the exposure is insufficient, this procedure is worthless. What are known as half-minute thermometers are not practical, as they are extremely delicate and break easily. It is very important that those whose temperatures are being taken should be watched carefully, as they frequently take out the instrument, keep their mouths open, or otherwise interfere with the proper registration. A very interesting fact has been observed in connection with this portion of the examination. A temperature of 100° F. does not necessarily signify an abnormal condition, as our records show that this temperature is frequently present in well persons, and is probably due to some slight or transient cause, as it commonly disappears within a few hours. A large percentage of the temperatures range from 99° to 99¼° F. in persons in a normal condition. However, the rules of this department now require the detention of all whose temperatures reach 100° or over.

I cannot conclude this article without a reference to modern sanitary regulations, the value of which has been so forcibly presented to us during the past two years. Since 1897 or 1898, the civilized world has been made uneasy by reports from India relative to the terrible ravages of the bubonic plague in that country, and the possibility of its appearance at European and other seaports has caused much apprehension. During the past two years, the disease has appeared at Oporto, Lisbon, Alexandria, Santos, Rio Janeiro, San Francisco, and Glasgow, but in no instance has it proved to be a serious menace to the public health, the outbreaks having been rapidly brought under control, and in all but one of the above places the disease has disappeared. In Glasgow, a city which has an enviable reputation for cleanliness and good sanitary conditions, the duration of the outbreak was exceedingly short, although the diseases existed some time before it was recognized. Then the above, no more conclusive evidence has ever been presented to show the absolute certainty with which outbreaks of infectious diseases can be controlled when good sanitary conditions, thorough inspection and observation, and cleanliness are maintained.

ELEMENTS OF DEFENSE AGAINST INFECTIOUS-CONTAGIOUS DISEASES, POSSESSED BY THE PORT OF VERACRUZ.

By MANUEL S. IGLESIAS, M. D.,

Delegate of the Superior Board of Health of the Mexican Republic, Veracruz, Mex.

There are three principal enemies against which Veracruz must defend itself; two that may come from abroad,—cholera and the bubonic plague, and one existant at home—yellow fever. Against the former, Veracruz relies on the medical visits made to every vessel that enters the port. These visits may be considered as divided into three classes—visits of inquiry, visits of inspection, and rigorous visits.

The visit of inquiry investigates the condition of the ports where the ship comes from, in the days precedent to its clearance, and the sanitary conditions of the same vessel during the voyage; the former being known by means of the bills of health given by the local sanitary authorities, certified to by the Consular Agents of the Republic or of some friendly nation, in their default, or by those given by the same agents. It is the duty of these Consular Agents, to which they strictly comply, whenever there prevails in their jurisdiction any of the before stated diseases, to notify the fact, by wire, to the Superior Board of Health in the City of Mexico, who transmits the news to its delegates, so that on the arrival of any vessel to a Mexican port the delegates already know the sanitary conditions of the foreign ports touched by the ship in its route. The sanitary condition of the vessel during the voyage is stated by the captain, or the physician on board, in writing, under his signature, answering every question relative to them.

In the investigation visit, and after knowing the conditions in which the vessel arrives by the contents of the documents aforementioned, the delegate goes on board and personally examines the passengers and crew, employing all the time he may judge necessary to get a thorough knowledge of their sanitary state. The delegate also examines the bills of lading in order to ascertain whether in the cargo there are any suspicious articles which require treatment. This visit becomes rigorous, extending itself to all and every one of the compartments of the ship, when, according to the information got by the means already explained, it is necessary to proceed thus.

It would take too long to enter into the details of all the cases that practice may present, but I deem it pertinent to mention the proceedings adopted, when by the medical visit, it is ascertained that a ship has arrived in an infectious condition, that is to say, with patients on board. In such cases the vessel is immediately sent to the anchoring ground in Sacrificios, about three miles from the port and in front of the island on which the Lazaretto stands. There the patients are landed to be taken care of by able attendants; the rest of the passengers and crew, who are in good health, remain on board, their baggage and clothes being taken to the disinfecting stove of the Lazaretto, which is placed in a department isolated from the one destined for the patients. Simultaneously the disinfection of the vessel is undertaken; the compartments for cargo and shut-up departments with sulphurous anyhydride (SO_2), obtained by the combustion of sulphur in the proportion of 30 grammes for each square meter of capacity, whose action is made to last during twenty-four hours; the parlors and cabins, which can remain shut, with formalin vapor, during ten hours. These are well ventilated afterwards; and in the interior of them an ammoniacal solution, in the proportion of eight grammes for each cubic meter, is evaporated in order to remove every trace of formalin. The other compartments of the ship are disinfected by means of a solution of bichloride of mercury, one in a thousand. In the water closets and urinals the sulphate of copper, four per cent. solution, is used, and the same in the hold, the water therein being changed as far as it is possible. Lastly, the water for the use of the persons on board is changed for clean and fresh water from the port. After these disinfecting operations, if seven days, in the case of cholera, and ten days in the case of the bubonic plague, have passed without the appearance of sickness on board (which is confirmed by a second rigorous visit), the ship is given pratique. The patients, when the evolution of the disease is over, and they have been bathed and their clothes and baggage disinfected in the stove of the Lazaretto, are permitted to come on shore. Then there is disinfection of that building and communication is re-established. The disinfection of baggage and clothes is made by means of steam at 115° centigrade, and at a pressure of seven hectogrammes per square centimeter. First, the air contained in the baggage is expelled by the introduction of steam, which is made to act at its greatest pressure during five minutes; then the valves are opened and again shut in order to reach as before the maximum of pressure, which is sustained during five minutes. This is repeated a third time, with which the disinfection is considered as finished, drying them (the clothes) by the simple action of air. In the case of mat-

tresses, pillow-cushions, etc., they are dried in the same stove, driving out the steam and allowing afterwards the entrance of air heated by making the steam pass through the battery of tubes in the walls of the stove. Articles made of silk, velvet, lace, plush and feathers, as also those that are gold-plated or silver-plated, are disinfected, using the formalin vapor, as they would be spoiled if this was done with the steam. The same would happen with articles of pasteboard or leather, and with those having metallic adornments. Anything of this kind is washed with a solution of bichloride of mercury and dried immediately afterwards.

Any ship which arrives without patients on board, but which has had them during the trip, or comes from an infected port, is considered as suspicious if less than seven days have elapsed since she cleared that port. In both cases the vessel is disinfected, as is also the baggage and clothes of the passengers and crew, in the manner stated, and the ship is submitted to a quarantine of observation, ranging in duration according to the disease on board. The count is made from the day on which the last case on board terminated, if the delegate can ascertain it, and if it is doubtful—from the date of the vessel's arrival, or from the date of her clearance from the infected port. If the ship coming from the infected port has had no sickness on board during the voyage, and this exceeds the seven days that have been mentioned, it is only submitted to disinfection, as above stated, and this being over, it is admitted to free pratique. From this practice are exempted those vessels that have on board a disinfection stove and a physician to take care of these operations, but always provided that, according to the delegate's judgment, disinfection has been well attended to.

The port of Veracruz has not to protect itself or take precautions against yellow fever, for it is a fact beyond all doubt that this port is one of the principal original foci of that disease.

In the other ports of the Republic, that have not the reputation of being foci for yellow fever, the practice followed when a vessel infected with that disease arrives, is the same as in the case of other sickness before referred to, leaving out the quarantine for passengers, which is suppressed. Immediately after landing these passengers are transported to places situated 1000 meters above the level of the sea, or more. If this cannot be done, they are required to report themselves to the authorities of the port during the seven following days, if they are not able to prove their immunity to the disease. The delegate's duty is to inform the authorities of the arrival of such persons in order that a strict sanitary vigilance may be held. This practice is adopted whether it be the case of an infected ship or of a

suspicious one, sending the sick to the Lazaretto, if there is one, or to a proper place where they can remain in perfect isolation. Only in cases where this is not possible will they remain on board the vessel, submitted to a quarantine of not more than five days since the last case terminated, after which the disinfection is made before admitting the vessel to free pratique.

Having, as I have already said, the enemy at home, all efforts are made to dislodge it. For it, as well as any other infectious disease, physicians as well as hospitals, must promptly notify the delegate and civil authority of all the sick they may assist in their practice. In this way information is obtained of the cases that occur in the town; and when the case has terminated disinfection is made of the apartments occupied by the sick and the clothes that were used by them. The disinfection of the apartments is done by moistening the floor with a solution of bichloride of mercury. All the clothes in the room, as well as those used by the sick persons, are put into bags to be taken to the disinfection stove in an hermetically sealed wagon, kept for this purpose. All the dust deposited upon the furniture, cornices, mouldings, etc., is removed by cloths moistened in the disinfecting solution; and with the same solution the walls of the apartment are cleaned, taking care to remove from them first all the furniture and fixtures in order that every spot may receive the disinfecting solution. Afterwards the furniture is also disinfected,—if it is common, by means of washings with the solution named, using painters' brushes for the mouldings and carvings, drying them immediately afterwards; but if they are made with tapestry or other similar matter, or with metallic adornments, gold-plated or silver-plated that may be altered by the solution, all the dust they may contain is removed by means of balls of tow or yarn that are afterwards thrown into the solution. Finally, the floors are disinfected, washing them energetically with the same solution; and in case they are very dirty or stained with greasy matters, blood, spittles, etc., they are rubbed with hard-brushes, the same being done in a similar way with the walls and roof. When all these operations are finished, the doors and windows are shut, all the chinks are covered with strips of paper pasted to them, and by the opening of a plate or a small hole in the door, the small tube of the formalin gas generating apparatus is introduced. The apparatus is made to operate outside of the room, till there is the certainty that a sufficient quantity of vapor has been introduced into the apartment. It is left shut during ten hours, after which all the doors and windows are opened in order to establish a sufficient ventilation, and the ammoniacal solution, mentioned when referring to the disinfection of vessels, is evaporated in order to

neutralize what may have remained of the formalin. During these ten hours there has been sufficient time to disinfect all the clothes in the disinfection stove.

Not yet satisfied with the adoption of these measures and their rigorous observance, the Mexican Government, convinced of the urgent necessity of improving the hygienic conditions of the town, has contracted for the construction of the necessary works to attain this end. These works for the present consist in removing from the city all refuse matters of the inhabitants, and furnishing to each of them a sufficient quantity of water. These improvements have been begun, and it is to be hoped they will be finished in a short time.

But as it is not sufficient to defend ourselves from the enemies that may attack us, humanitarian feelings oblige us to also defend those that may find themselves in a similar danger. Our authorities inspired by these elevated ideas have ordered the disinfection of suspicious merchandise and of the baggage of passengers, before they leave the port. As nothing of this character is allowed to leave without the fulfillment of this requisite, it is possible to affirm that the propagation of the disease by articles is totally prevented.

The exact compliance to these regulations presents difficulties in practice, for the owners of merchandise, as well as passengers, try to elude the prescriptions of the law, deceiving the vigilance of the authorities whose duty it is to have them fulfilled, by every way that fancy can devise. But we think we have arrived to such a degree of perfection in this service that, without uselessly damaging the interests of the public, we may assure that not one suspicious article of merchandise nor a single passenger leaves this port without the knowledge of the sanitary delegation. To realize this desideratum with respect to the merchandise, the Custom House Collector cannot consent to the shipment of suspicious goods from the port, without a certificate given by the sanitary delegation, wherein is is stated they have been disinfected. If the goods come from the interior of the Republic, which is verified by the railroad documents, given in the railroad stations, and provided that from the railroad cars they be transferred to the vessel without passing through the city, they are not disinfected. The baggage of passengers coming from the interior, who pass through the city without stopping, is not disinfected either; but to prevent passengers from trying to deceive the authorities, it is exacted that before baggage is taken out of the railroad station the respective documents be exhibited, these documents being noted and the packages immediately taken to the Disinfection Office, where a label is put on them testifying that they have been examined. Goods belonging to passengers who cannot comply with these rules, are

subjected to disinfection, though the owners may allege that they do not reside in the port or that they have only remained a few hours in it. In either case a ticket is given them stating if their baggage has been disinfected and the number of packages; or if they have not been disinfected, the reason for so doing; and no steamship company sells passenger tickets without the exhibition of the aforesaid ticket, as also no vessel admits on board baggage that has not fixed to it the label by which it is proved that they have been examined in the Disinfection Office.

To conclude, I may say that the designs and account of cost of the new building that has been projected for the Delegation Office. are already approved by the Supreme Government, and the building will soon be built. It will be divided into two ample departments, one of them destined for the disinfection of passengers and their baggage, furnished with shower baths and cold and hot water at will, with separate divisions for ladies and gentlemen, in first, second and third classes, and with three disinfection stoves. The other department is also divided into two parts; one for the examination and inspection of passengers and for offices, and the other destined to incinerate those matters that must be destroyed in order to preserve public health, and store rooms for the disinfection of susceptible merchandise.

My country being a nation but little known, that only a few years ago began to attract the attention of the world, it is natural that the greatest part of its laws, institutions and proceedings are generally ignored in all those affairs concerning the life of nations, especially from the international point of view, and I think it is the duty of every one of her sons to make them known whenever the opportunity offers itself, so that we may be judged with a thorough knowledge of the facts, and that we may be placed in the grade we may deserve. For this reason, I hope your forebearance will pardon me for having entered into such minute details, explaining rules and proceedings well known to every one of the honorable members of this Association who have had the kindness to listen to me.

REPORT OF THE COMMITTEE ON CAUSE AND PREVENTION OF INFECTIOUS DISEASES.

By A. WALTER SUITER, A. M., M. D., Chairman,
Herkimer, New York.

Mr. President, and Gentlemen of the Association—Circumstances of an unavoidable character having prevented the elaboration of an exhaustive report upon all topics pertaining to the work assigned. The proper discharge of the duties of this committee requires that it shall offer some remarks, however brief and non-comprehensive, touching the *status praesens* of those infections which are engaging the careful attention of sanitarians and which threaten the personal and commercial interests of the public at large.

The limit of time allotted for the presentation of this report of course precludes the possibility of an *in extenso* discussion of the various phases of all questions that properly come within the scope comprehended by the organization of the committee, and the numerous subjects entrusted. Your committee will therefore declare its purpose to be content to simply touch upon and chronicle some events which may be deemed of sufficient importance, making no attempt at originality and offering no special considerations.

Beginning with the exanthematous diseases, there is very little to be added to what has already been stated in previous reports of this committee. Smallpox continues to be widely prevalent throughout the United States and contiguous countries. Indeed there seems to be reason to believe that the epidemic is rather increasing than declining as to the number of cases, but the same peculiar characteristics and low mortality rate, which have been the occasion for so much controversy and such direful consequences in many instances during the several years last past, still obtain. Some idea of the apparently increased prevalence, together with the mortality returns, may be derived from the following statistics taken from the recent issues of the Public Health Reports of the United States Marine Hospital Service:

Total number of cases reported for the six months beginning December 29, 1899, and ending June 29, 1900	12,566
Total number of deaths	682
Total number of cases same period 1899	8,649
Total number of deaths same period 1899	500
Total number of cases reported from June 29, 1900, to August 24, 1900	3,546
Total number of deaths	108
Total number of cases same period 1899	808
Total number of deaths same period 1899	3

By this it will be observed that while there has been a notable increase in the number of cases reported during the current year the mortality rate has declined quite as notably as compared with the corresponding period of time during the preceding year. This apparent decrease in mortality in separate periods of time must not, however, be regarded optimistically as experience in epidemiology has always shown that diseases, the prevalence of which is ordinarily attended by great fatality, cannot be long continued without assuming their characteristic virulence however insignificant the death rate may be.

Your committee regards it a cause for great regret and concern that the closing years of this nineteenth century should be marked by so widespread an epidemic of a disease, the absolute control and even complete extermination of which was made possible by the wisdom of the thereby immortalized Jenner one hundred years ago. Reproachful indeed does it seem that the experience and practical demonstrations of a century have failed to establish, in the public mind and among governmental authorities, the beneficent necessity of self-protection from this loathsome disease by uniform and more energetic compulsory vaccination laws and their faithful and rigid execution, with penal consequence for non-compliance. It is undeniably the fact that the most important factor in the dissemination and spread of the present epidemic is the great diversity of professional opinion regarding the diagnosis. The extreme mildness of the disease in most of the outbreaks, together with the adherence of many professional attendants to text-book descriptions of symptomatology, tend constantly to confusion most unfortunate in results. "Cuban itch," "chicken pox," "elephant itch," "nigger itch," "impetigo contagioso," "Porto Rican chicken pox" are some of the terms which are said to have been used to designate the eruptive disease and by which apparently innocent expressions large numbers of communities have deceived themselves, with the resulting consequence of neglecting the application of necessary measures for prevention and thereby increasing the areas of infection.

The deplorable history of the ravages of smallpox in the past has led to the establishment of a popular belief in the non-possibility of an epidemic that is not attended with an appalling mortality, and this opinion is shared to a considerable extent by physicians whose inexperience does not enable them to depart from the contemplation of the classic symptoms of a typical form of disease. It has commonly been noted that where outbreaks have been reported under the names above mentioned, official investigation has proved them almost invariably to be, without doubt, *variola vera*. Another notable fact is

that whenever such diagnosis is made and the formula—"isolate, vaccinate and disinfect"—is rigidly applied and enforced, the abatement of the infection at once begins and the public health is promptly restored. Bearing upon the preventive efficacy of scientific vaccination, to which it is hardly necessary to refer in this presence, it is worth while to mention that in the Island of Puerto Rico, lately ceded to the United States, smallpox though formerly prevalent has been completely banished by the enforced vaccination, under governmental direction, of the entire population of 800,000 inhabitants.

While the specific etiologic factor in scarlatina is still *sub judice*, and far from satisfactory demonstration, some late developments in this important field of investigation are quite worthy of note. Somewhat more than one year ago Medical Inspector, Dr. W. J. Class of the Chicago Health Department described a diplococcus found in the blood, scales and throat of typical cases of scarlatina that he subsequently observed to be pathogenic for various animals, especially mice, guinea-pigs and swine, reproducing the characteristic manifestations of the disease. He also obtained pure cultures from the blood of these susceptible animals during life and also from the organs after death. His investigations have been repeatedly confirmed by himself as well as some other investigators. It would seem that Koch's laws were successfully met and that the proofs obtained point toward the establishment of specificity.

In a recent contribution by Adolph Baginsky and Paul Sommerfeld (Berliner Klinische Wochenschrift, 2d and 9th July, 1900), the discovery is announced of a micro-organism constantly present in the throat and blood of scarlet fever patients which they believe to be the probable causative germ.

In an article by Dr. Class (Journal American Medical Association, 21st September, 1900), quotations are made from the article of Drs. Baginsky and Sommerfeld to call attention to "the similarity in many particulars" of the so-called diplococcus scarlatinæ to the germ discovered by them. Should the observations of the German observers prove to be confirmatory of those of Dr. Class a great advance will be made toward general acceptance, and the final solution of this very important problem so closely related to sanitary science.

In the last report of this committee extended reference was made to the study of the theory of the inoculation of certain diseases into the human body by diptera—more especially that of the inoculation of the malarial parasite. Continuing that attractive subject it may be said that more recent studies and experimentation seem to have removed the question from the realm of theory to that of established fact, and no one apparently doubts at the present time the proofs

offered in the work and voluminous observations of the devoted followers of this interesting line of research. The splendid investigations of Surgeon-Major Ross of the Indian Medical Service have been supplemented and confirmed by later experiments of the Italian observers, Grassi, Bastianelli and Bignami, and many others in various countries. From all that has been demonstrated the following as stated by Thayer (Philadelphia Medical Journal, May 5, 1900), can be gathered as proved:

"1. That the malarial parasite possesses an extra-corporeal cycle which is completed in the stomach wall of mosquitoes of the genus anopheles," and—

"2. That members of the genus anopheles can transmit malaria from infected to non-infected individuals."

The important questions then arise, as mentioned by the writer last quoted:

"Is this the only method by which malaria may be acquired?"

"Can the mosquito acquire the infectious agent only from man?"

These and several other equally important questions still remain for solution.

It must be said that thus far no more has been proved than the above stated propositions, but this is sufficiently significant to fully justify the war of extermination that has already been declared against the infectious insect, especially by the scientists in England and Italy—to be promptly followed without doubt by similar hostile crusades in the United States, and other countries.

The most recent experiments of both negative and positive character to verify the mosquito-malaria theory have been undertaken during the past summer, and are so striking and seemingly so conclusive as to merit reproduction. The negative evidence is sought by the residence of several experimenters with their servants in Italy, near Ostia, in those localities of the Roman Campagna that have the reputation of being most malarious, with no protection whatever from the reception of the plasmodium through the medium of the water or air, but absolutely protected from the bites of the anopheles. The latest reports (September 13th) state that no malarious infection has been manifested among these men—thus proving conclusively the negative side of the question. The positive side has been proven in an equally conclusive manner by an experiment of Dr. Patrick Manson on the person of his son in London. The experiment is described by the Journal of Tropical Medicine for September, quoted by the New York Medical Record, from an editorial article of which these facts are taken:

"At Dr. Manson's request, three batches of anopheles were fed in Rome by Dr. Bastianelli on three separate malarials (tertians) and forwarded in cages to the London School of Tropical Medicine. Dr. Manson's son, P. Thurburn Manson, was bitten every second day until they died—usualy about ten days after their arrival in London. The first batch was fed in London on the first and second week of July, the second at the end of August, and the last during the second week of this month. The subject of this experiment remained in perfect health till the morning of September 13th, when headache, bone-ache, lassitude and anorexia, with rise of temperature to 102° set in. On the 15th there was a distinct intermission during the forenoon. High fever, 104°, set in about 4 p. m., with delirium, relieved during the night by profuse diaphoresis. The same series of events recurred on the 16th. On the morning of the 17th, tertian parasites were found in the blood."

The Record remarks that "this is unquestionably the most conclusive of the inoculative experiments yet made, for the possibility of infection by other channels, which was present in the Roman experiments, and to a less degree in a similar one which we understand was carried out in New York this summer, was here eliminated. Dr. Manson's son could not get tertian fever in London in any ordinary way, and he has not been in a malarious country since his childhood, therefore there can be little room for doubt as to the agency of the imported mosquitoes in the causation of his illness."

All facts bearing upon the cause and prevention of typhoid fever are of peculiar and abiding interest,—a disease having an estimated yearly prevalence of 500,000 cases in the United States alone, with a mortality approaching if not exceeding 50,000. During the past year much time and thought have been expended in the elucidation of some of the important problems connected therewith, and from the reports many pertinent and useful points may be gleaned. The continued discussion upon the differentiation of the bacillus typhosus from the bacillus coli commune, and the relationship of the former as the true etiologic factor in the production of typhoid fever, was supplemented during the year by an extremely interesting article (Annals of the Pasteur Institute, August, 1900, tr. by Dr. H. D. Geddings, U. S. M. H. S.), by L. Rémy, M. D., of the State Analytical Laboratory, Liége, Belgium—revealing a new method of procedure in the bacteriologic study of the Eberth bacillus in stools and water. He divides the discussion into three distinct periods:

First. The discovery of the bacillus by Eberth in 1880 and its critical study and confirmation by Gaffky in 1883.

Second. The discovery of the bacillus coli commune by Escherich, which introduced skepticism as to the differentiation of the Eberth bacillus and the bacillus coli commune, and brought about the denial of the specificity of the bacillus typhosus; and

Third. The application of the Elsner potato gelatin method for the recovery of the germ, and the discovery of the agglutinating property of the Eberth bacillus by the specific blood serum.

Rémy describes a new differential gelatin medium and details conclusive experimental observations. Some of his conclusions follow:

"The typhoid bacilli isolated from the stools of typhoid patients belong to one and the same type; they do not give indol, do not ferment lactose, and are all agglutinated by a high dilution of the experimental serum."

"The typhoid bacilli isolated from the stools in the course of the second week, as well as those isolated from the spleen at necropsy, possess remarkable vital energy. On the contrary the bacilli which are found in the stools at the end of the disease have only feeble vitality."

"In three cases the typhoid bacillus was found in the stools when the signs of typhoid fever, including the serum reaction, were wanting at the time of the examination. Consequently the typhoid bacillus, with its attributes as we know it, is the only sign, which taken alone, can justify the clinician in asserting positively the diagnosis of typhoid."

"In the stools of persons stricken with infections other than typhoid we have found no genuine typhoid bacilli."

"The constant presence of the bacillus typhosus in the stools of persons stricken with typhoid fever, its absence in the intestines of persons stricken with other diseases, renders it possible to assert that the bacillus typhosus is in truth the causative agent in typhoid fever."

Typhoid fever in camps was made the subject of study by the U. S. Government, at the request of the Surgeon-General U. S. A., through the appointment of a commission for that purpose in August, 1898—the Spanish-American war furnishing the opportunity. The report of the commission, which will without doubt be a classic of its kind, will not be published for some time to come. In view of that fact one of the members, Surgeon-Major Victor C. Vaughan, presented some of the more important conclusions reached, as the oration in medicine before the American Medical Association in June last. Dr. Vaughan showed that more than 80 per cent. of the total deaths in the late war were from typhoid fever, that the percentage of deaths among typhoid fever cases was about 7.5 per cent., that the investigations confirm the doctrine of the specific origin, and that the theory that typhoid fever

may be evolved from simple diarrhœa, the colon bacillus acquiring such alteration as to be converted into the typhoid bacillus, was conclusively controverted. An exceedingly important and suggestive statement made by Dr. Vaughan was that "the elimination of typhoid bacilli begins soon after infection which, if true, makes an individual a source of danger during the entire period of incubation, and suggest the disinfection of the stools of all, both sick and well." "Camp pollution was the greatest sanitary sin committed by the troops." Flies undoubtedly served as carriers of the infection." It is more than likely that men transported infected material on their persons or in their clothing and thus disseminated the disease. "It is probable that the infection was disseminated to some extent through air in the form of dust."

The investigations of the commission showed that the infections of malaria and typhoid might be coincident, but the symptoms were not well enough defined to constitute a separate disease, and that the shortest period of incubation in typhoid fever is probably something under eight days. Again: "One who has lived in a camp in which typhoid fever is prevalent is liable to develop this disease any time within eight weeks after leaving such a camp."

As will be readily appreciated all these statements have immense practical value if further observations substantiate them.

The inoculating experiments that have been practiced for some time past in India and in South Africa for the prevention of typhoid fever, as well as cholera, have not reached a stage where it can be said that satisfactory practical results have been obtained. Nor can we safely predict from data at hand the final outcome of this commendable effort. Reports as to the use of the anti-typhoid serum among the troops in South Africa show some figures that are remarkable as to apparent success in immunization, and tend to justify a hope that the means for protection against both these deadly infections will soon be established.

Most important events have transpired during the past year in relation to the threatened pandemic of bubonic plague. This horrible malady, with its appalling mortality of from 50 to 90 per cent., has prevailed in greater or less degree as to severity and extent from a time almost beyond date. Until the somewhat recent recrudescence, however, the ravages of the disease have been confined to countries in the Eastern Hemisphere. This recrudescence began in 1893 in Tonkin and Hong Kong in China, and in British India. Thence it spread extensively, and by agencies practically unknown, involving far distant localities in the Orient, and finally made its appearance for the first time in the knowledge of man in the Western Hemis-

phere at Santos, Brazil, one of the port cities of South America, in October, 1899.

Spreading slowly but surely, until during the past year outbreaks of the infection have been reported in South Africa, Egypt, Spain, Portugal, England, Philippine Islands, and, during the past summer, in Honolulu and San Francisco. Very recently in Glasgow, Scotland an epidemic of considerable proportions has developed which in some respects is a more menacing situation to the people of Europe and America than any outbreak that has yet appeared. The comparatively close proximity to the Atlantic ports of entry and the extensive commercial relations, together with the indifference to quarantine regulations in the British Isles and the consequent possibility that ambulant cases may pass unrecognized, are quite sufficient to justify the apprehensions and fears for the safety of this part of the world that are now felt by sanitary authorities.

While it appears to your committee that the probability of a disastrous visitation of this dreaded epidemic is extremely small, in view of the superior sanitary conditions of progressive civilization compared with those of oriental countries, and the greatly improved knowledge of this disease, we yet feel that it comes properly within the scope of our official functions to extend a note of warning upon the principle that it is wise "in time of peace to prepare for war."

Experience and observation constantly show that the crowded and filthy conditions that prevail in most oriental cities are the prime factors for the propagation and continuance of the epidemic influence, and that by proper hygienic management under modern methods, with the absolute isolation of those attacked and the segregation of so-called suspects, the limitation of the spread of the disease is practicaly secure.

Previous to the investigations of Kitasato and Yersin in 1894 very little was known concerning the origin and propagation of this infection. The simultaneous discovery by these observers of the causative germ was an achievement in science of rank with those of Pasteur and Koch, and marked the beginning of studies and experiments which have resulted in adding so much to our knowledge concerning the viability of the germ, and the means that can be employed to inhibit and destroy its activity, as to make it seem reasonable to declare that we are at the present time in quite the same position to meet and successfully combat the dissemination of this disease, as we are to restrict and prevent the ravages of Asiatic cholera which, as is well known, long since "met its Waterloo" at the hands of science.

It is now well established that the life of the bacillus is affected greatly by conditions of heat, the action of chemicals, moisture and light, as is shown by the following statements taken from the article on Bubonic Plague by Surgeon-General Walter Wyman, U. S. M. H. S., and published by the Treasury Department at Washington: "The organism is killed by a temperature of 55° centigrade for ten minutes; by 80° C. for five minutes. Corrosive sublimate solution 1-1000 destroys the bacilli immediately; 1 per cent. carbolic acid and 1 per cent. lysol in ten minutes. Mineral acids are very effective. Sulphuric acid, 1-1000, kills the bacilli in five minutes; hydrochloric acid, 1-1000, in thirty minutes."

The report of the German Plague Commission (quoted by Dr. Wyman), states: "The longest time that infected material, as lint, wadding, earth, etc., remained active was eight days. Sputum from patients affected with the pneumonic form, kept in a vessel plugged with cotton wool, was no longer virulent in sixteen days. In ordinary drinking water the bacilli die in three days, in sterilized water in eight days, and in sterilized bilge water in five days." According to Bowhill (quoted by Dr. Wyman), "The bacilli are killed by drying at ordinary room temperatures in four days."

By the foregoing it will be observed that the ordinary methods of disinfection employed to limit the spread of all other infections are likewise applicable to plague.

The latest reports indicate the firm establishment of the theory that rats and other vermin, bugs, flies, mosquitoes, fleas, and some animals of higher order, are active agents in the transmission and spread of the disease, and without doubt in comparison with them all the common domestic rat, being most susceptible to the infection and having habits of peculiarly dangerous character in this respect, occupies first place as a carrier of the infectious element.

A committee of the French "Academie de Medicine" made the following statement (quoted by Dr. Wyman): "The plague, which is at first a disease of rats, soon becomes a disease of man. It is not unreasonable to think that a good prophylactic measure against plague would be the destruction of rats."

How the infection is conveyed from rat to rat and from rat to man is still a subject of controversy. In the matter of the conveyance of the infection much attention is now being given to the so-called ambulant cases of the disease, or *pestis minor*. In this form the virus exists in an attenuated condition attended by glandular swellings and suppurations, but, as the name implies, unattended by

severe constitutional disturbances, although quite capable of furnishing in some manner a focus for spreading the infection in most virulent type. Such cases deserve the most careful observation.

Much evidence appears in recent reports to demonstrate the immense value of the curative influence of the anti-plague serum evolved by Yersin, on the one hand, and the immunizing qualities of the vaccinal fluid produced by Haffkine, on the other. Briefly these remarkable agents may be described as follows:

The Yersin serum is the product resulting from the injection into the blood of the horse of increasing doses of the toxins of the plague bacillus until the system of the horse ceases to react, and the serum obtained is sufficiently strong to immunize a mouse of 25 grams weight against cultures of the living bacillus, and also lethal doses of the toxins themselves. It is then presumed to have developed its antitoxic or curative power. The time required to complete this operation amounts to from seven months to one year. Of this substance the curative dose is from 30 to 50 c.c. repeated if necessary once or twice. The substance possesses both preventive and curative power. The Haffkine prophylactic is much easier and more rapidly prepared and consists of a product obtained from the culture of the bacillus pestis in ordinary agar-agar or bouillon for twenty-one to twenty-eight days at 37° centigrade, and subsequent exposure for two hours to a temperature of 70° centigrade, thus killing the growth. The immunizing dose of this agent is 1 c.c., conferring immunity for at least three months and, according to "statistics collected from British India, the percentage of protection in those vaccinated once is about 85 per cent.; in those vaccinated twice or more it is 95 to 100 per cent."

P. A. Surgeon H. D. Geddings, U. S. M. H. S., this concludes a recent article containing a complete exposition of this interesting subject:

"There is no infallible remedy against plague. The anti-plague serum is largely effectual and has much diminished the mortality among those treated by it. In the Haffkine prophylactic we have an agent which is readily producible in large quantities, is free from danger when used under proper precautions, and with which it is feasible to confer an effectual immunity against plague in whole villages, cities or districts. Taken in connection with reasonably enlightened sanitary precautions, thorough disinfection, and those measures which have proven of so much value in other contagious or infectious diseases, we may say with certainty or affirm with confi-

dence that in the anti-plague serum and in the Haffkine prophylactic we have remedies with which we can successfully combat a disease which in former times has baffled all human skill."

Although it is quite well understood that the matter presented in this report conveys but little more than material that may serve as texts for discussion, your committee ventures to hope that—

"Forsan et halc olim meminisse juvabit."

INFLUENCE OF TEMPERATURE ON VACCINE VIRUS.

By Dr. W. F. ELGIN, Philadelphia, Pa.

Part I.

COLD.

It has always been the popular assumption that germ life was incompatible with extreme cold, and that in fact most germs, especially of a pathogenic nature, were destroyed by a freezing temperature. Frisch (1877) found, however, that cultures exposed to —87 C. continued to multiply when exposed to favorable conditions.

Prudden's experiments later are more or less familiar. He found that the proteus and prodigiosus were killed in 51 days; the staphylococcus aureus, however, withstood freezing for 61 days; the bacillus of typhoid fever was active after being in Hudson River ice for 103 days.

Cadêac and Malet kept a portion of a tuberculous lung frozen for four months, and found that at the end of that time he could inoculate guinea-pigs with the material and produce tuberculosis.

Koch found that cholera could be cooled to 32° C. and still retain its vitality.

More recently, liquid air and hydrogen have been utilized to obtain an extremely low temperature, to which bacteria have been subjected for a short time.

McFayden of Edinburgh, under Prof. Dewars' direction, subjected a number of organisms: B. typhosus; B. diphtheria; spir. choleræ (Asiaticæ); staphylococcus pyogenes aureus; and several pathogenic bacteria, to temperatures as low as —210° C., with no impairment to their protoplasmic activity.

These experiments would seem to suggest that a low temperature might with profit be applied to the storage of vaccine, since of all biological products this is acknowledged as being one of the most unstable, often becoming inert without any appreciable cause. Dr. John Huddlestone of New York Vaccine Department informed me that he had subjected the virus to the temperature of liquid air without impairment of its activity. This, however, for only a short time.

Through the kindness of Mr. John McKey, Superintendent of the Reading Terminal Cold Storage Plant, Philadelphia, arrangements were made to place samples of virus in constant temperatures, as follows: 4, 2, 0, —3, —9, —15 deg. C. At the same time a similar sample was placed in our own ice-cabinet, which was maintained at a

temperature of from 11 to 13 deg. C. Three forms of virus were prepared, No. 1, dried points; No. 2, the glycerinated lymph according to our usual laboratory formula; and No. 3, pulp ground with distilled water alone. From April 3d to May 16th, samples of especially active virus prepared as already indicated were stored in these temperatures. On June 13th, samples of the virus, after having been in a temperature of —15 deg. C. for 74 days, was removed and individually inoculated on a calf, No. 176-D, care being taken that the various specimens were not mixed; while at the same time petri dishes were planted with the same specimens of virus by the loop method on 1 per cent. peptone agar. Six days thereafter the animal was examined and the results noted as follows: Dry points from calf No. 126-D, showed slight irritation along the lines of incision but nothing suggestive of a typical vaccine vesicle. Points from No. 124-D showed a few scattered vesicles only, with the irritation as before mentioned. Pulp and distilled water mixture, from No. 124 and No. 126-D, gave fine large vesicles, but accompanied with excessive inflammation showing vaccination plus an infection; while the glycerinated lymph from No. 126 and 127-D showed normal sized vesicles with slight excessive inflammation. As a control, one section of the animal was vaccinated with glycerinated lymph from No. 126-D that had been stored in our ice-cabinet at a temperature of from 11 to 13 deg. C. This produced normal sized vesicles without excessive inflammation.

From the bacteriological report, I will quote as follows: Single dry point, No. 126-D, showed about 18,112 colonies. The hay bacillus, staphylococcus albus and a bacillus resembling the colon, predominating. Single point, No. 127-D, showed about the same number of colonies and a like variety. Pulp and distilled water mixture from calf No. 124-D showed 6916 colonies, and the microscope showed apparently a pure culture of staphylococcus albus. The same mixture from No. 126-D gave 17,344 colonies, while the cover-slip showed staph. albus and bacillus subtilis. A specimen of glycerinated lymph from No. 126-D showed 2624 colonies, while No. 127-D showed 22,224 colonies, among which staphy. albus and bacillus subtilis predominated. Lastly the same mixture from No. 126-D stored at a temperature of 12 deg. C. (above freezing) showed no growth on the petri dish whatever.

This was interesting to me in suggesting that glycerine would not destroy bacteria except at temperatures above freezing. Experiments were continued along this line during the past summer, at intervals, but the time allotted me will not permit of a further discussion. I will mention in passing, however, one of the more recent experiments.

September 25th, glycerinated lymph, pulp and distilled water, and dried points were taken from storage at temperatures 12, 4 and —15

deg. C. Having been subjected to these temperatures for 132 days and inoculated on an animal as before described, with the usual bacteriological control. October 1st, an examination of the calf showed that the points were practically inert; pulp and distilled water stored at 4 deg. C. was practically valueless; pulp and distilled water at 15 deg. C. was fairly active; while the glycerinated lymph at all temperatures was active. Bacteriological report as follows: Dried points, 4000 and 2700 colonies per point, respectively at 4 and —15 deg. C.; while glycerinated lymph at temperature —15, showed 1225 colonies; at 4 deg., 120 colonies and at 12 deg. the specimen was free from germs. Experiments still continue to determine, if possible, the life of the virus under these conditions.

Part II.

HEAT.

What is perhaps the more interesting, as it is the more important, to the general practitioner is the influence of heat on vaccine, and in this connection permit me to say that, in my judgment, the condition of the animal from which the vaccine is taken plays an important part. One instance I recall, in which the calf developed an extreme enteritis, followed in spite of treatment with collapse and consequent depression of cutaneous circulation. The animal died on the eighth day after vaccination, but the vaccine did not develop after the point attained until about the fourth day, when the intestinal trouble began to be pronounced. Other instances have been noted where the animals came up fairly well, but were troubled with diarrhea, and I didn't think the virus from this source was as resistant of meterological conditions as that taken from perfectly normal animals. The strain of virus itself again seems to exert an influence, some being more hardy than others. It is probable also that the character of the contaminating germs may have some influence upon the life and death of the active principle of vaccine. Copeman claims that lymph freed of bacteria gives more nearly typical results than the same lymph when fresh, and containing numerous unnecessary germs. In reference to temperature, however, he speaks as follows in a paper in 1891:

"After a long series of experiments with lymph, exposed to various temperatures, between the limits mentioned and for varying lengths of time I have apparently determined that the required temperature is one ranging between 38 and 40 deg. C. * * * At the same time, however, the higher temperature appears occasionally to exert an injurious effect on the lymph as far as regards the normal vesiculation which should result from the inoculation of vaccine lymph." But few writers on vaccine have considered this question of temperature. Cory does not mention it. He only suggesting that "preserved lymph should never be used when it can be avoided, for failure is so much more frequent after its use." He does not refer to glycerinated lymph. Dr. Richard Slee, in a letter to me in regard to this matter,

says: "With regard to how great a heat virus will stand, my impression is that there is no fixed degree. * * * I believe, however, that a temperature above 80 deg. is very trying and rapidly kills a large portion of active virus." The doctor probably refers to the Fahrenheit scale. The following letter from Dr. Huddlestone, upon this subject, I will quote in full: "The temperature experiments of which I spoke to you have been made on five specimens of virus. Capillary tubes of every one of these have been placed, part in a room kept at 70 deg. F., and part in an incubator kept at 37 deg. C. Every three days a tube of every specimen of virus was taken from each place and tested by primary vaccination on a child. The shortest period at which any specimen in the incubator became inefficient was eight days; the longest period a specimen retained its efficiency was 14 days. None of the specimens placed at room temperature of 70 deg. F. have yet failed; though one of the specimens that was longest exposed, proved efficient at 111 days." Now when you remember that 37 deg. C. is equivalent to practically 98 deg. F., and that this temperature is frequently attained in summer in various parts of the United States, and also that what is equally as important and probably more destructive to vaccine, is that this temperature has a 24-hour variation of as much as twenty or more degrees, you can readily understand why the best virus occasionally fails in warm weather. My experience seems to show that a changeable temperature is as destructive to virus as a constant hot one.

Now, in conclusion, permit me to call your attention briefly to some lessons suggested by these experiments.

(1) Points are unreliable when stored for any length of time at any temperature.

(2) Virus on points may be inert, yet germs charged along with the virus remain active, giving a form of irritation somewhat resembling vaccine vesicles, known as *spurious vaccination.*

(3) That glycerine will not destroy the extraneous bacteria in lymph when stored at or below the freezing point.

(4) That continued exposure of germs to low temperatures when constant does not destroy their activity and but slightly decreases their number.

(5) Hot and especially variable temperatures speedily injure vaccine.

(6) Hot temperatures enormously increase the number of germs in fluid lymph other than that stored in glycerine.

THE ONLY CERTAIN PROPHYLAXIS AGAINST SMALLPOX IS HUMAN VACCINE WHICH, IF WELL INOCULATED, DOES NOT TRANSMIT INFECTIOUS-CONTAGIOUS NOR DIATHETIC DISEASE.

By Dr. SALVADOR GARCÍADIEGO,

Guadalajara, Jelisco, Mexico.

Smallpox was introduced from Europe by the Spaniards, and developed for the first time in Hayti in the year 1517, passing into Mexico in the year following, where it committed ravages amongst the indigenous races. From that time, whenever an epidemic has appeared in our country, it has been observed that the natives who have not been vaccinated, and especially amongst the nomad tribes, very easily contract this disease whenever they come into contact with residents of localities in which some epidemic is raging.

The susceptibility of the indigenous races to smallpox is so great that some of them take this disease twice in their lives, and it has been observed that after suffering two attacks they finally succumb to the third, as happened to an Indian who lived in the village of Chapala and who died of this disease at the age of sixty years, after having suffered two previous attacks. This fact is very interesting as it demonstrated the efficiency of the vaccine as a prophylactic measure, seeing that individuals who are inoculated with humanized lymph acquire the most perfect immunity against smallpox. Taking into account the great susceptibilty of the aboriginal races to this disease when they are not vaccinated, it is evident that this immunity cannot proceed from any other source than vaccination.

The individuals of the mixed as well as the pure indigenous and European races, although not so susceptible, are nevertheless by no means exempt from attacks of smallpox when they have not been vaccinated, and the Anglo-Americans, in spite of their being vaccinated with animal lymph, easily catch the disease when living in the localities where it prevails—a circumstance which is well worthy of attention, and one that proves the inferiority of this, as compared with human vaccine for preservation against smallpox.

The necessity of periodical revaccination with animal lymph, and the fact that the characteristic pustules again appear, clearly demonstrate that its preservative action is limited, and that it is extinguished after the lapse of a certain time. On the other hand, the great difficulty that is found in producing true vaccine pustules when individuals are reinoculated with human vaccine proves the indefinite duration of this prophylactic measure, and its superiority over animal vaccine.

These observations, which are from our daily practice in Mexico, and have been perfectly demonstrated by statistical data, were carefully studied and presented in an important paper on this subject at the Twelfth International Medical Congress, which was held in Moscow in the year 1897, by my esteemed friend, the eminent clinician and hygienist, Professor Dr. Eduardo Licéaga.

He there very clearly proves the efficacy of human vaccine against smallpox, and the permanent immunity which it confers.

Facts of such great importance from a hygienic and anthropological point of view, supported by the practice of the Mexican physicians, ought not to be passed over by a learned audience such as this, and ought to be utilized so that hereafter we may be able to obtain complete immunity for the inhabitants of the northern continent of America, whose medical delegates are here met.

There is an important fact demonstrated in Dr. Licéaga's paper, which shows that the Mexican physicians who attended persons attacked by smallpox during the epidemics that have appeared in our country are not subject to contagion, as they are perfectly well protected by the vaccination which they have received in their infancy. So true is this observation and so perfect is this confidence on the part of the physicians of my country, that without the slightest hesitation we approach a patient suffering from this disease, without any fear of contagion.

Having demonstrated the prophylactic efficacy of human vaccine by the above facts and reasonings, we can understand how the numerous series of successive vaccinations have given it stability and fixed character. Also that its preservative powers increase, or at least are maintained in the numerous inoculations which are made in the same medium of cultivation, that is to say, in the human organism, as otherwise its preservative effects would now be exhausted. To the above arguments we may also add, that the practice of vaccination with animal vaccine, requires for its germination or development, the destruction of the epidermis and part of the dermis with the ivory points that are used, or else large and deep incisions; whilst in using humanized lymph, the reproduction can be obtained by a single puncture of the skin.

The unfounded imputation which has been made, for the purpose of discrediting the use of human vaccine, that is a medium for the transmission of infectious-contagious or diathetic diseases, is altogether unreasonable and is nothing more that a mere theory, as has been fully proved by experience.

Whenever the technical operation has been correctly made, with instruments in a proper condition of cleanliness, and care has been taken to use no lymph that is mixed with blood, the Mexican physicians have always been able to make certain that the vaccine germ which is taken from the pustules of a healthy child, or from tubes which have been filled from the same source, never results in the de-

velopment of any disease. When, through the carelessness or negligence of the vaccinators, they have made use of dirty instruments, or of lymph which is mixed with blood or other impurity, erysipelas has developed, it has been generally of a mild character and confined to the arms. Now, when everyone understands so well the importance of aseptic precautions, this danger has entirely disappeared, as no physician would dare to use infected or dirty instruments, or apply lymph that was anything but perfectly pure.

If it were true that human vaccine was capable of serving as a medium for the transmission of the mentioned diseases, the present population of Mexico would show it, considering that for a whole century human lymph has been constantly employed for vaccination in our country. Errors of this kind do not require any refutation.

To the above considerations we ought to add another important point, that the human serum which appears to be the most appropriate medium for the cultivation of vaccine, is not a good medium for the transmission of these diseases, every one of which has its own especial channel of contagion. If this serum should become vitiated by any pathological process it would be impure and could not develop the pustules which are characteristic of the real vaccine. It would produce abortive pustules, or those of such a poor character, for the want of nutritive elements in the culture medium, that they would be of no use for collecting normal lymph, and therefore would be considered unfit for the propagation of vaccine.

To an audience of this character I do not need to present further details; but I should like to state the operative technique that for many years has been employed by Dr. Polanco in Guadalajara. Placing a drop of vaccine lymph on the skin of the arm, he introduces the point of the lancet in the center of that drop penetrating the skin in a very oblique direction and raising the point of the lancet in such a way as to open slightly the lips of the wound, thus permitting the lymph to fill the cavity that is formed and penetrate into the thickness of the dermis. The success of this process is certain; and it can also be applied with animal vaccine.

Should the scientific facts and arguments that I have had the honor of presenting to this Association, succeed in drawing its attention to the good results that for a century have been obtained in Mexico through the use of human vaccine, I would beg that a committee of Anglo-American and Canadian physicians be appointed to make a practical study of the subject, and should the results of that study be as satisfactory and convincing as those obtained in Mexico, that they be reported in the meeting of the coming year, in order that having acquired a conviction of the efficacy of human vaccine, of its innocuous character and its superiority over animal vaccine as a prophylactic against smallpox, its application may be sanctioned by this learned Association, and generally adopted in our continent.

HUMAN VACCINE, AS A PROPHYLACTIC OF SMALLPOX; ITS ADVANTAGES AND DISADVANTAGES.

By Dr. FRANCISCO P. BERNALDEZ, Mexico, Mex.

Being now in charge of the vaccination office in the City of Mexico, and having had an experience of nine years in the administration of vaccine as sanitary agent of the second ward of that city, I desire to explain to this learned meeting of hygienists, the way in which we carry out this prophylactic operation against smallpox, and our reasons for adopting this system, notwithstanding the contrary opinion of some eminent physicians. By the observations and statistics of many years, that is to say, ever since vaccine was brought over from Spain by Dr. Balmis in the year 1804, during the reign of Charles IV, it has become a well-proved fact to us that vaccination from arm to arm, or otherwise, with humanized vaccine is entirely innocuous, provided that this operation be made with all necessary care; that the immunity which it confers against the variolic infection is of a permanent and not of a temporary character; and lastly, that by its means we obtain a higher degree of immunity than that obtained from animal vaccine. In order to attain these results, that at present appear marvelous to people who have not preserved human vaccine, but have always relied on that obtained from animals, we require certain conditions that I will briefly explain.

The most serious blame made against vaccination from arm to arm, that which caused it to be abandoned and animal vaccine substituted is the possibility that it may serve as the means for the transmission of certain diseases, such as syphilis and tuberculosis.

As regards the last named disease, tuberculosis, science has not as yet been able to establish any facts to prove its transmission by means of vaccine. Our statistics do not show any cases of this disease caused by human vaccine. The possibility of transmitting tuberculosis from the vaccinated child to the person who is operated on with his lymph is the same as if the animal vaccine were employed; because the calf which furnishes the lymph is just as likely to be suffering from tuberculosis as the child who replaces it. If science has means at its disposal for recognizing this disease in the calf, it has the same means, and even better ones, to diagnose it in the child.

The possibility of transmitting syphilis through human vaccine is a well established fact, that has been proved both by experiment and observation.[1] The substitution of human for animal vaccine was

[1] On Dr. Cory's experiments in vaccinating himself from syphilitic children—Medical Report of the Local Government Board, London, 1883, p. 46.

principally brought about by this well established fact. The reason that animal has been substituted for humanized virus is that the calf is not like man, adapted to the development of the syphilitic virus; every experiment that has been made with the purpose of inoculating calves with that disease has completely failed.

As a matter of fact, several cases have been observed of syphilitic vaccine, but if care is taken to analyze each one of them we will find that such cases were observed when it was believed that the vaccine virus, like all others, never associated itself to the constitutional vices of the vaccinated individual, theories that induced Steinbrenner[1] to say, "It would be as absurd to believe that syphilis was communicated to the inoculated person by the use of lymph which was taken from a syphilitic subject, as to believe that the inoculation of the pus from the chancre of an individual who at that moment had fine vaccination pustules could vaccinate the person who was operated on."

Many other eminent physicians of that time were of the same opinion, amongst whom we find Husson, Bousquet, Guersant, Blache, etc. The eminent Chomel, a noted professor of that period, used to say: "I cannot believe that the pustule of vaccination is capable of containing, besides the liquor that properly belongs to it, the germ or generating principle of any other disease, such as syphilis."

It is easy to understand that, owing to the prevalence of such ideas at that time, no precautions were taken to avoid contagion in the practice of vaccination. The negligence was so great on this point, that I cannot do less than copy the text of a paragraph from the article on vaccination, in the Medical Dictionary of Guersant, Vol. 30, page 414, (1846.)

"A great number of children suffering from itch, scarlatina, measles, chickenpox and several skin diseases, have furnished vaccine lymph which has never communicated any of those contagious diseases. The same thing has happened when the lymph has been taken from individuals suffering from rickets, scrofula, syphilis, etc."

Knowing the danger we can avoid it easily.

Ever since the vaccine lymph was first brought to Mexico, special care has been taken in the selection of the children who are to furnish the lymph for propagation, and it is due to this circumstance that we have absolutely no record of a case in which syphilis has been transmitted through vaccination.

We do not utilize any person for the production of vaccine lymph who is not over four months of age. It has been perfectly well established that hereditary syphilis necessarily manifests itself within the first three months of life; so that a child over four months old, who

[1] Treatise on Vaccination, 1846.

has presented no indications of this disease, can be accepted with almost absolute certainty as not syphilitic. This opinion has been confirmed by one of the most distinguished experts on syphilis of the present day, Dr. Fournier, who is accepted as an authority on the subject. Notwithstanding this, we inquire in each case into the antecedents of the parents, so as to avoid making use of the lymph in the event of there being any suspicion of syphilitic antecedents, or of any transmissible disease. And we go even further yet, and if we find that any child from whom it is desired to take lymph fulfills the above condition, but is at the same time affected by any eruption of the skin, this is sufficient to cause his refusal.

As regards the vaccine pustules, these must be seven days old, that is to say, be fully developed without having suppurated; and when the lymph is found to be turbid and have a purulent aspect, it is refused. Besides this, if through any accident when puncturing the pustule to obtain the lymph, blood should be drawn, the lymph is then refused, because the blood constitutes the vehicle rather than the lymph for the inoculation of transmissible diseases.

The child selected, and before taking the lymph from his pustules, these must be made aseptic by washing them with sterilized water; not with antiseptic solutions, which, as experience has taught, sterilizes the lymph, or attenuates its immunizing properties, as I will show later on.

It has been objected against the use of human vaccine, that it presents the difficulty of not having a sufficient number of vaccinated children always available, so as to be able to make a satisfactory selection amongst them of the number that is indispensable for the propagation of the virus. In order to overcome this difficulty, the Vaccination Office in the City of Mexico has arranged to give rewards to the parents of the vaccinated children, in the hope that this will bring them back after a lapse of eight days, so as to have a large number of vaccinated children from whom to select. This practice has given the best results in Mexico, and is not costly, as the rewards are small. It is due to this that we are never short of the lymph necessary for the vaccinations, and for preserving in sufficient quantity to distribute throughout the Republic.

By proceeding in the manner above described, and by having the vaccine administered by persons who are experts on the subject, we have not observed in Mexico, as I have already said, a single case of the transmission of syphilis by vaccination.

In order to increase the precautions, and avoid in an almost certain manner the transmission of any contagious disease, special care is taken, at the time of registering the children who are vaccinated, to enter in a special column, those who may be affected by any disease of the skin, so as to refuse them for the purposes of transmission, as well as to prevent the eruption being attributed to the vaccination as the immediate cause.

All these children who are vaccinated are obliged to present themselves at the office after the lapse of eight days in order that they may receive a certificate of vaccination, which is only given to them when the operation has given satisfactory results, and without which they are not admitted into any school.

All the people who are vaccinated receive a printed paper, containing the instructions as to the precautions they must take during the period of evolution of the vaccine, to avoid the subsequent appearance of erysipelas, lymphangitis, and other similar diseases that might supervene through the want of the special knowledge required in these cases.

We have already stated that the immunity against smallpox which is conferred by human vaccine is permanent and not temporary.

In fact, a long experience has taught us in Mexico that the humanized vaccine protects against smallpox during the whole life, and amongst us it is well known that revaccination is useless, because the results are negative, and because it is enough to be inoculated once with human vaccine for the prophylaxis of smallpox to be final and complete. But in order to obtain this result it is necessary that the vaccination should fulfill certain conditions.

The number of vaccine pustules, *i. e.*, the quantity of vaccine lymph which is inoculated has a great effect on the degree of immunity which is acquired against the virus of smallpox. The science of bacteriology has already taught us that in proportion to the amount and virulence of the vaccine in general that an organism can support the greater is the degree of immunity conferred and its duration.

We do not consider an individual to have been well vaccinated, when after the lapse of eight days from inoculation, he only presents one pustule, and if the second inoculation is not successful we recommend that a fresh attempt at vaccination be made after the lapse of some time. If, on the contrary, there have been several inoculations which have developed six or eight pustules of true vaccine, we consider that the vaccinated person will enjoy freedom throughout his whole life from any infection of smallpox.

Another condition required for the human vaccine to confer a permanent immunity, is not to commit the error of taking false vaccine as good. This precaution, which at first sight appears so easy and simple, presents grave difficulties in practice, however perfectly marked are the characteristics which theory teaches us for the distinction between the two. It is for this reason that vaccinated people, who have been inoculated with false vaccine, have suffered, to the great astonishment of their friends, attacks of confluent smallpox. Several characteristics have been assigned to the pustules of true vaccine, so as to distinguish them from the false, such as the red circle which surrounds it, its umbilication, its long period of incubation as compared with that of the false vaccine, which is very short, the form of the scars which it leaves, etc.; but in order to make the

distinction with absolute certainty, it is necessary to have had a long experience and to have observed numerous cases.

Amongst the persons who have been vaccinated in those countries in which it is the custom to use animal vaccine, revaccination is almost always successful, and for this reason the Supreme Board of Health has issued circulars to the Consuls, recommending them to have their countrymen vaccinated or revaccinated, if they have already gone through that operation in their own countries.

In a book called "Syphilis from Vaccination," which Dr. Fournier wrote in 1886, at page 165, we read as follows:

"Does animal vaccine preserve with less certainty and for a shorter time against smallpox, than humanized vaccine? It is true that as yet we know nothing about it, and any opinion regarding one or the other of these points, and especially the latter, would be premature. This question is one of those on which no final judgment can be pronounced except by our sons or grandsons, that is to say, at the cost of innumerable observations and of a very long experience which is wanting today."

This very long experience which Dr. Fournier so justly desires for the discovery of the truth on those points that he has submitted to discussion, thanks to the fact of our having for the long period of ninety-six years carefully preserved the human vaccine, and kept it under a minute and careful observation, can be fully furnished by the Mexican physicians, who can all confirm the unquestionable facts presented in this paper, which I have had the honor to read to this learned assembly.

THE JENNER VACCINE WELL PRESERVED AND CAREFULLY PROPAGATED IS A PERMANENT PRESERVATIVE AGAINST SMALLPOX.

By Dr. EDUARDO LICÉAGA, Mexico, Mex.

At the meeting of this Association, which took place in Minneapolis last year, a discussion arose with regard to vaccine as a preservative against smallpox. In it I explained the doctrine accepted in Mexico: that the humanized vaccine, discovered by Jenner, which he propagated, and which has made his name immortal, is that which has been used in the Republic of Mexico, almost without exception, during all of the present century. This statement caused the greatest astonishment among the audience, and, if the proverbial courtesy of the members of this Association prevented them from declaring their incredulity of the fact, I nevertheless understood, from the friendly protests arising on all sides, that I proposed a backward step in a matter of hygiene that has been definitely conquered by science.

To all the colleagues who manifested their astonishment at this statement I promised to present a series of data upon which I based myself in sustaining that the humanized vaccine, that of Jenner, gave immunity for a life time, and that we should return to the primitive practice of that benefactor of humanity.

I now fulfill my promise by translating into your language the paper which I wrote in 1897:

"There are questions that seem to have been definitely resolved, and which are not; there are doctrines almost universally accepted which should not have been until after they had been submitted to new studies. The doctrine of the prophylaxis of smallpox belongs to this order.

"It seems rather too bold to throw doubt on certain principles admitted as scientific axioms. But I have such a deep conviction in the thesis which I sustain; the proofs on which it rests are so irrefutable, and my desire of being useful to huamnity is so great that I hope my boldness will be pardoned.

"The proofs which I present are not the result of the experience of one single man, nor of a scientific society, nor taken from one single city. They are the result of the experience of a whole people, that of Mexico, where the theory of Jenner has maintained itself intact during ninety-three years, that is to say, since 1804, date on which the vaccine was introduced, until the year 1897.

"In Mexico animal vaccine has not entered into the ordinary practice of medicine. It is thirty years since the enthusiastic innovators,

carried away by the marvels which had been told of animal vaccine, tried to introduce it into the country. A memorable struggle then took place in the National Academy of Medicine, and also in the medical and political press, between the partisans of the animal vaccine and those of the humanized vaccine, a struggle in which the arguments on one side and the other were submitted to severe judgment. The success was definitely for the Jenner vaccine, which continues to be propagated in Mexico with the same care as heretofore. It is true that some establishments for the propagation of animal vaccine were created, which had but small success and short duration, as they could not compete against the service of the humanized vaccine which, perfectly organized, is now admirably conducted in the capital. If it is true that the Sanitary Code recommends the Board of Health to establish an animal vaccine institute; it is not less true that only some hundred people have been vaccinated with this last preservative, and this so recently, that the fact cannot be invoked for a solution of this question. We can then affirm that during the whole of the present century only humanized vaccine has been used in the Republic of Mexico. This stated, experience has demonstrated that it is sufficient to have been vaccinated during infancy, from arm to arm, to enjoy immunity from smallpox for life. In fact, during epidemics, smallpox never attacks those who have been vaccinated, if they be doctors or nurses who, from their profession, are most exposed to contagion; and among the doctors of the country, who have been vaccinated, *there has never been a single death caused by smallpox.*

"The revolutions which upheaved the country for many years before the era of peace procured by the wise administration of General Porfirio Diaz, the actual President of the Republic, have not permitted the perfect establishment of a vaccine service, neither in all the cities nor in all the rural districts; on that account epidemics of smallpox have been frequent. But as soon as these broke out the administration augmented the vaccine service and a little after the smallpox would disappear.

"The contrast presented by the number of deaths from smallpox during 1893 (year in which the vaccine service had been neglected) and the number of deaths caused by that disease during the following year is an evident proof of the efficiency of vaccine in arresting epidemics of smallpox. During the former period the number of deaths reached 267, but as vaccination increased the number of deaths during the latter period descended to 40. This contrast has been observed in all the epidemics. I should, at the same time, call attention to the fact that during those epidemics only persons (infants or adults) not previously vaccinated were vaccinated.

"In Mexico recourse has never been had to revaccination, as it is not necessary. There, as elsewhere, it has often been observed that

the vaccination will take on an individual who has already been vaccinated; but these are isolated cases, even though the partisans of revaccination have carefully investigated them. The vaccine can take on a subject already vaccinated, like the smallpox can, in exceptional cases, attack an individual already vaccinated, or likewise a person who has already had the smallpox. But such cases are very rare in Mexico, and I only refer to them here as evidence of my good faith in the exposition of the facts; they are so rare that they do not, at the end, affect the general rule.

"In all our statistics the mortality from smallpox takes place, entirely, among infants and adults who have never been vaccinated.

If revaccination were necessary in Mexico, the smallpox would attack non-vaccinated infants and adults in the same proportion. As we do not revaccinate, the contingent of adults in the mortality from smallpox should be as high or higher than that of infants. If this is not so, it is because the person who has been vaccinated in infancy enjoys immunity for life.

"A fact which I desire to call to the attention of those who wish to study this question impartially, is that in the epidemics observed in the capital of our Republic during the last years, it has been noted that the deaths from smallpox have been almost entirely among foreigners.

"This has been observed so frequently, that the Board of Health of Mexico has been obliged to notify foreigners, through their respective Ministers and consuls, that they should be vaccinated, if they were not already, or revaccinated if they had already been vaccinated in their respective countries. This last was advised by the Board, as it had the conviction that in countries where animal vaccine is used and the propagation of good vaccine neglected, it is in those countries where revaccination is necessary. On the other hand, not being able to convince each individual foreigner of the necessity of this, it has been necessary to allow each to be revaccinated in conformity with the custom of his country.

"I am certain that foreigners residing in Mexico are attacked by smallpox because in their respective countries they have been vaccinated with animal vaccine, which certainly produces only temporary immunity, a thing which has been repeatedly proved in Europe. Animal vaccine giving only temporary immunity forcibly imposes the obligation of revaccination in order to enjoy protection against smallpox.

"The deaths caused by smallpox among adults have been largely among foreigners residing in Mexico, because the original population of that city has been vaccinated, as will be seen by the following figures:

TABLE INDICATING THE NUMBER OF VACCINATIONS IN THE CAPITAL OF MEXICO, DURING A PERIOD OF 25 YEARS, FROM THE 1st OF JUNE, 1872, FROM WHICH DATE THE BOARD OF HEALTH HAS HAD CHARGE OF THIS SERVICE, TO THE 30th OF JUNE, 1897.

Years.	Vaccinations.		Totals.
	Central Office.	Branch Office.	
1872	2,605	1,335	4,130
1873	14,538	4,761	19,299
1874	7,784	2,722	10,506
1875	8,663	3,265	11,929
1876	6.300	2,559	8,859
1877	3,372	1,505	4,877
1878	3,130	1,381	4,511
1879	3,011	2,641	5,562
1880	2,835	7,533	10,368
1881	3,459	7,615	11,084
1882	6,777	4,190	10,967
1883	8,230	7,221	15,451
1884	8,975	6,346	15,319
1885	8,789	3,196	11,981
1886	9,434	5,337	14,771
1887	8,672	6,050	14,722
1888	8,966	6,421	15,387
1889	9,807	16,589	26,396
1890	7,106	16,287	23,396
1891	11,203	12,499	23,702
1892	6,441	18,968	25,409
1893	7,408	16,060	23,468
1894	6,423	14,513	20,936
1895	5,649	14,112	19,661
1896	5,785	17,376	21,162
1897, primier semestre	6,435	10,381	16,816
Total	181,991	210,885	392,866

"The vaccination service of the Capital has been under the direction of the Board of Health since the month of June, 1872, until now. During this period of 25 years, 392,866 individuals have been vaccinated. The census of the Capital for 1895 gives a population of 344,377 inhabitants.

"It can then be said that all of the original population of the city has been vaccinated. Besides, as the vaccination has not been continued with regularity, that is to say, as the births took place, during certain periods many infants have been exposed to contracting smallpox.

"From the foregoing, it results that individuals born in Mexico and well vaccinated have not suffered from smallpox, and that foreigners who have not been well vaccinated or have been vaccinated with animal vaccine, have formed the largest contingent in the mortality among adults.

"It might be objected that, if the Jenner vaccine gives immunity for life in Mexico, it is due to particular conditions of race or of the climate; we can reply to this by stating that there exists in Mexico an indigenous race, a white race of various nationalities, and a mixed race of the two, and that therefore the benefit acquired cannot be attributed to a racial particularity. We will say as much for a so-called climatic condition, for if a part of the country is situated in the torrid zone, the central plateau of the Republic, with its great altitudes, gives the country a variety of climates. Neither can it be attributed to the bacteriological characteristics of the vaccine virus being different from those of Europe, as the analysis and examinations made by Dr. Prieto have shown that they are identical.

"The secret of the permanent immunity given by the Jenner vaccine is that it has been preserved with extraordinary care, that it has been taken from very healthy subjects, that the best pustules are selected (those which represent the primitive type of the vaccine) to propagate it and from which the lymph is taken during maturity, never before nor afterwards.

"This degree of perfection in the preservation and propagation of the prophylactic has been obtained in Mexico, thanks to the circumstance that the care of the vaccine during 93 years has been confided exclusively to four persons. In fact, King Charles IV of Spain sent the first vaccine to his colony of New Spain in 1804, specially charging the preservation and propagation of it to Dr. Francisco Javier de Salmiz, who took such care of it that it lost none of its primitive purity. When Dr. Salmiz returned to Spain, he left it in the hands of Dr. Antonio Serrano and Dr. Migul Muñoz, to whom the municipal authorities confided the duty of preserving and propagating the vaccine. Their service lasted until 1842. From the hands of these gentlemen it passed into those of Mr. Luis Muñoz, a man who combined with his long experience a great enthusiasm, and who rendered the greatest services to the cause to which he devoted himself. He preserved it until 1872, since which time it has been under the care of Dr. Fernando Malanco. All these persons have made such a deep study of the vaccine, have taken such care in the selection of the persons from whom the vaccine is taken, in the selection of the pustules (only taking the very pure lymph) in the epoch of their maturity, they have so elevated their mission to the height of a cult, that I have no hesitation in affirming that to this zeal and experience we owe results equal to those obtained by Jenner; to these also is due the permanent preservative virtue of our vaccine. On the other hand, the vaccine virus taken by the Board of Health is that which is used nearly all over the Republic.

"In cities where there are vaccine institutes, the lymph which has been used to found these also comes from the capital, so that all the lymph employed in Mexican territory continues to reunite all the conditions of purity of that of the capital.

"Modern studies on vaccines explain in a satisfactory manner the good results which the Jenner vaccine has given in Mexico. In fact when a virus passes through an animal organism of the same kind, we are able to give it such a degree of stability that its effects are always identical.

In the present case, the cowpox from the calf has passed thousands of times through man, and by a careful selection has acquired its stability, and with it, the maximum of preservative strength. If the best type of vaccine is selected for propagating, the effects produced by the first type will continue to reproduce themselves indefinitely.

In resumé, experience and science counsel the return to the practice of Jenner so that vaccine will again produce permanent immunity against smallpox."

NEWARK'S (N. J.) ANTITOXINE PLANT—ITS RESULTS AND COST.

By H. C. H. HEROLD, M. D.,

President Board of Health, Newark, N. J.

Early in 1895, after much opposition from some of our city officials and from members of the medical profession, a laboratory for bacteriological research, with attendant plant for the application of the antitoxine remedy for diphtheria was established under the jurisdiction of the Board of Health in the city of Newark. That department has now been in practical operation for more than five years, and I desire, for the benefit of public departments of health and hygiene throughout the country, to present as succintly as possible the results of the experiment as viewed from the standpoint of both the physician and financier.

First, let us consider clinical results. Our Newark laboratory was established in February, 1895, with an appropriation of $5,000, made by the Mayor and Common Council to the Board of Health. Newark antitoxine, by which I mean antitoxine made in our own laboratory, was first used in June, 1895. Prior to that year, with a sporadic use by a few physicians of a purchased, inferior article, the number of cases each year and the number of deaths resultant, had been as follows:

Diphtheria. (*Before the use of Antitoxine.*)

1891	447 cases	175 deaths.	
1892	523 "	193 "	
1893	357 "	144 "	
1894	466 "	180 "	
Total	1798 cases.	692 deaths.	38%

This table shows an average rate of death each year, in proportion to the number of cases reported, of from 35 per cent. to 40 per cent.

The hospital mortality in these years was still greater, ranging as high as 45 per cent., which was doubtless owing to the seriousness of most of the cases taken to those institutions.

Since the introduction of antitoxine, that is, since June, 1895, there has been a steady decrease in the proportion of deaths to cases, due unquestionably to the gradually extended use of the remedy placed at the disposal of our physicians.

The records of the city show that for the years between 1894 and 1900 the cases reported each year, together with the number of deaths each year, were as follows:

Diphtheria Cases and Deaths. (*Since the use of Antitoxine.*)

1895	1321 cases.	273 deaths.	
1896	1261 "	218 "	
1897	969 "	137 "	
1898	1019 "	133 "	
1899	1170 "	124 "	
Total, 5 yrs..	5740 cases.	885 deaths.	15 4-10%

Here then is a decrease from 38 per cent. in the four years prior to 1895, to 15 4-10 per cent. in the five years succeeding and including 1895, during the part of which first mentioned year the laboratory had not been completed. But these figures do not express all of the results. There should be taken into consideration also, in forming an intelligent judgment of the result, the number of cases in which antitoxine was used and the number of cases in which antitoxine was not used, and a comparison made between the effect of the two methods of practice. Few cities have such records, but in Newark they have been accurately kept since the establishment of our bacteriological laboratory.

Naturally, in the mildest cases, where there seems to be little danger, some physicians are disinclined to administer the remedy, while in cases where death is imminent even the most antagonistic practitioner is fairly certain to use antitoxine as a last resort, but too late. Therefore, in the statement of the cases where antitoxine is not used, there is necessarily a larger proportion of very mild attacks.

The records of Newark show the following:

1. DIPHTHERIA. (*Antitoxine not used.*)

1895	937 cases.	221 deaths.	23 %
1896	356 "	112 "	31 %
1897	406 "	76 "	19 %
1898	373 "	65 "	17½%
1899	372 "	54 "	14½%

2. DIPHTHERIA. (*Antitoxine used.*)

1895	384 cases.	52 deaths.	13%
1896	905 "	106 "	11 7-10%
1897	563 "	61 "	11%
1898	646 "	68 "	10 5-10%
1899	798 "	70 "	8 77-100%

These figures show far more forcibly than any theoretical argument the great value of this remedy when administered through the medium of a proper system. The old high mortality prior to 1895 has been diminished from an average of 38 per cent. to 15 4-10 per cent. whether antitoxine was used or not, and that this decrease is directly due to the intelligent use of the remedy is still further proved by the fact that where antitoxine was used the rate had decreased to less than 9 per cent. Obviously if the remedy had been employed in every case the general proportionate rate of deaths to cases could not have been higher than the rate in those cases where the remedy was used.

Before this branch of the subject is dismissed these few observations may be worth noting: The total number of our cases seems large for a city of 250,000 inhabitants. This is due not only to the growth of our municipality, but also to the greater precision of diagnosis. We establish the presence of true diphtheria by the discovery of the Klebs-Lœffler bacillus in the culture taken from the throat of

the patient and microscopically examined. This system reveals the fact that many cases of sore throat, stomatitis, etc., must be included in the list. But we also accept the clinical diagnosis of the physician. It is fair to assume that for reasons which will be shown in the financial statement that cases are far better reported in our city than in cities which have no laboratory.

Experience shows that the earlier antitoxine is used—preferably within the first three days—the better is the result obtained. It has been said that to-day more cases of post-diphtheritic paralysis are found than formerly, and it has even been charged that antitoxine is responsible for it. The real reason for the existence of post-diphtheritic paralysis is that the life of the patient is prolonged by antitoxine and the paralysis thereupon becomes observable in extreme cases. If antitoxine were used at the beginning in sufficiently large doses no paralysis could or would develop.

Slight rashes and urticaria may occur, but there is no albuminuria, nephritis or bad results which can be credited to the properly prepared antitoxine. Whatever unfortunate symptoms observable are a part of the disease itself.

Antitoxine should not be too timidly given in bad cases. The dose should be repeated in twelve hours, especially when bronchopneumonia is imminent or apparent. The bacilli appear in large numbers in these cases. The tendency now is toward the use of higher units. Our antitoxine is not less than 2,500 units, and ranges as high as 4,000 units; but we may go still higher.

In concluding this department of the subject, I desire to add that no bad fatality has ever resulted from the use of antitoxine in the city of Newark, and it has been conclusively demonstrated by the scientific use of the remedy that diphtheria is a disease whose bad prognosis can be and is changed to a disease whose prognosis is good. We do not consider that we have by any means arrived at the lowest percentage of deaths to cases which may be obtained by the use of the remedy, and we are convinced from the experience of other cities similarly situated that where other methods are employed in treating this ailment, that with the abandonment of our antitoxine plant and the use of its produce, the mortality would rise again to the highest percentage of former years.

That you may properly understand the manner in which the department is financiered in Newark I desire to state that we have a completely equipped laboratory. We have a bacteriologist who has two assistants. We have a culture collector who each day collects the culture tubes from twenty-one stations in an area of 18½ square miles. The population of the city, as I have said, is 250,000. We also have five antitoxine horses maintained for that use alone. Not only is the laboratory free to all the physicians in the city, but the antitoxine is supplied free and the tubes collected at the department's

expense. A small income is derived from the sale of the remedy to a few neighboring towns and from the use of the laboratory by non-residents; but no charge whatever is made for anything to our own citizens.

The cost of maintaining the department since its establishment has been as follows:

LABORATORY APPROPRIATIONS AND EXPENSES.

1895.	Appropriation	$5,000 00	
	Disbursements	3,713 29	$3,713 29
Balance turned into general fund		$1,286 71	
1896.	Salaries	2,164 00	
	Supplies	2,699 78	4,863 78
1897.	Salaries	$3,095 00	
	Supplies	1,760 86	4,855 86
1898.	Salaries	$3,781 68	
	Supplies	2,200 40	5,982 08
1899.	Salaries	$3,820 00	
	Supplies	2,184 52	6,004 52
Total			$25,419 53

RECEIPTS. (*To be deducted.*)

1895	$157 00
1896	290 50
1897	318 90
1898	328 50
1899	390 40
Total	$1,485 30

Total expense, 5 years	$25,419 53
Less	1,485 30
Net	$23,934 23
Average yearly expense	$4,786 85

The work of the department in 1899 may be tabulated as follows:

1.	Diphtheria Examinations. (Primary and secondary cultures.)	2,907
2.	Vials of diphtheria Antitoxine produced	1,975
3.	Examinations of sputa for Tubercle Bacilli	799
4.	Blood examinations for Typhoid, Malaria, etc	717
5.	Water and milk analysis and examinations	416

These figures do not fully describe the capacity of the plant. Our production of antitoxine could, for instance, be easily quadrupled at slight cost. The same work if performed at the usual laboratory rates would cost double the amount expended.

We consider, therefore, as a financial investment, that the laboratory pays, and we encourage its free use. We are anxious that its boon shall be known and made use of by all our citizens. We can produce the highest standard antitoxine at a net expense of not over 53 cents per vial. Rich and poor alike share not alone in the em-

ployment of the remedy, but are at liberty to call upon the bacteriologist and his assistants for all proper purposes.

Periodical examinations are made of the drinking water of the city, and the attention of the proper authorities are called at once to pollution whenever it is found to exist, and where food and drink presumed to be deleterious are offered they are examined gratuitously and a report returned. All this work must be included among the benefits obtained from the very small expenditure of money appropriated annually from the Common Council.

Under the old system, or rather absence of system, we would have had in 1899—445 deaths as a result of the 1,170 cases of diphtheria reported in 1899. We had as a matter of fact but 124 deaths, many of them due to the failure to use antitoxine. It can be reasonably claimed, therefore, that 321 lives were saved in that year at a net expense to the city, excluding a consideration of other benefits derived, of $6,000. How much more than the whole of this $6,000 was each of those 321 lives worth?

REPORT OF THE COMMITTEE ON CAR SANITATION.

By S. H. WOODBRIDGE, Chairman.

The willingness of many responsible for the sanitary condition of railway cars and stations to serve the public, in the matter of health protection, to the limit of their ability and of rational demand is made evident by the report rendered by your committee at the last meeting of the Association, and by the correspondence of your committee with a considerable number of the railroad managements in the states, provinces and Mexico. An examination of that report must prove most gratifying to those who have heretofore regarded railroad managements as indifferent to the interests of the health of their patrons. It is, nevertheless, true that less than one-half of the managements addressed favored your committee with a response, and also that some of those who failed to give the information wanted concerning the practice of their roads in sanitary matters are among the largest railroad companies of the continent. It seems probable that either an unwillingness to coöperate, or an indifference concerning coöperation, with the efforts of the Association is responsible for the failure of some of the companies to respond to the communications sent them by your committee in behalf of the Association.

It is not improbable that the disposition toward the matter of not a few of the railroad managements is voiced in the following extract from a letter received by your committee from an officer of one of the railway companies addressed. Because of the nature of the questions presented in the letter referred to, and also because of the opportunity the letter offers the Association to state its position with regard to these questions, the following quotation is herewith presented. The letter is one received in answer to the circular letters sent to seventy or more of the railroad managements of the continent, and printed as part of your committee's last report.

"You ask a number of questions in regard to the care of cars which are not easy to answer, and which I hesitate to answer until I know the use you intend making of them. If this information is desired in the cause of science, that is one thing; if it is desired in order to compel the railroads through legislation to adopt expensive methods of sanitation, I hesitate very much to give you the information. I am quite certain that the railroad with which I am connected, and other trunk lines in this vicinity, are doing quite as much in regard to protecting the traveling public against contagious diseases

as they can afford to do, and it is quite a question in my mind whether any public or semi-public institution can be expected to do more for the public than the public will do for itself. Public opinion is such that people who ought to be in quarantine are traveling around at large, and it does not seem to me that you ought to expect transportation companies, hotel keepers, or other institutions to protect the public against them. Railroads are, as you know, considered in law 'common carriers.' They must carry whoever comes along, and regulations in regard to not spitting in cars, etc., are usually of no avail."

"In the matter of sterilized water at various places, it is a great question in my mind whether railroads can go into this matter. While waters of guaranteed purity are usually used in dining cars and eating houses, in the ordinary water tanks of sleeping and passenger cars, railroads simply furnish the best water which they are able to get from the cities and towns through which they run. Take for example, the city of Chicago, a very large proportion of the population drinks the lake water as it comes from the faucet, and this is what is supplied in the cars of all railroads running out of Chicago. A very small proportion of the population do not use this water at home and purchase water in bottles and cans. Would you contend that it was the duty of the railroad companies to furnish water to its patrons which was better and more expensive than those patrons would think of using in their own homes?"

"The steam railroads are at the present time in active competition with electric lines, especially in suburban traffic and traffic between large towns when not too far apart. The railroads furnish waiting rooms with appliances for the comfort of passengers on their trains which their competitors do not furnish, and many prominent railroad managers feel that they have already gone further than they can afford to in this direction."

It seems not impossible that this extract represents the unexpressed sentiment of the thirty-nine or more railroad managements out of the seventy or more addressed, who failed to respond to the inquiries made a year ago by your committee. In view of this fact it seems not inappropriate to state the aims of the Association as understood by your committee, and also to state the grounds upon which your committee assumed to institute the inquiries made. The aim of the Association is held to be one of coöperation in the advancement of knowledge pertaining to matters of public health, and in the betterment of means and of practice to that end. Your committee, acting in behalf of the Association, seeks, under the follow-

ing well-grounded assumptions, to promote that knowledge and improve such practice.

1. The public through its chosen form of government has unquestionable right to protect itself from such preventable danger as it is in its power to control.

2. A danger is constituted whenever existing conditions are a menace to the best state of life, health, property or happiness.

3. From various causes, many of the dangers to health increase in number and potency with the aggregation of persons in various conditions of health, and especially when such persons are assembled in illy-aired and illy-cleaned enclosures.

4. The public right is unchallenged to demand good hygienic conditions in all buildings and conveyances designed for public use and dependent, in their origin and operation, on public franchise.

5. The public standards, so far from being gauged by private, or family, or local habits, often conflict with and overrule them when the latter are at variance with the public good.

6. In the matter of public hygiene the State is supreme over any part of its contained communities and industries.

It is proper, therefore, and frequently imperative, that the town or municipality should require, for example, better sanitary conditions in school buildings, or in other places of public resort, than may exist in the homes of those who frequent such buildings or places. If the town or city fails to protect its own by suitable hygienic precautions, the State is not only justified in compelling the delinquent town or city to maintain public sanitary conditions, but in the protection of other communities it is bound to compel such maintenance. Unfortunately, it often does not do so, and in practice, owing to local influence, or state legislation often cannot. Nevertheless the faulty standards of a city in the matter of foods, milk supply, water, air and cleanliness cannot fix the state standards. Furthermore, state requirements, while fixing the local minimum standards within commonwealths, do not otherwise limit such standards. Railroad managements are, therefore, not justified, morally at least, in fixing the sanitary standards of their roads by those of some or any cities or towns through which their roads run. The interest of a larger community should influence and determine those standards. If it has been Chicago's misfortune to be compelled to drink water of questionable quality, in that fact can be found no justification, except possibly a purely legal and technical one, for inflicting this misfortune and attending danger on those who pass through or out of that city to other parts of the state and the country, and who

carry with them to others the menace of a disease to which they may have been exposed through local misfortunes or mismanagement.

Your committee hold the opinion that in blameworthiness and criminality those who through negligence expose others to danger are but one step removed from those who deliberately expose their fellows to a like danger. Any man who with intention furnishes his customers with adulterated milk, polluted water, vitiated air, is unquestionably amenable to law. The man who through indifference and negligence does the same thing is an equally dangerous transgressor against the public health and rights, and should be equally under the restraint of the public will expressed in and operative through law.

Your committee further believe that attending the travel of millions of people in public conveyances are avoidable dangers which many, and perhaps most, of the railway managements recognize and do much to lessen,—while others minimize and are indifferent to them. It seems also reasonable to assume, first, that the former class would desire or welcome a statement of general directions or suggestions in regard to a rational and practical safe-guarding of the health of passengers, issued by such a representative, conservative and authoritative body of experts as is the American Public Health Association; and, second, that those devoid of such desire should be compelled under the restraint of law or public opprobrium to interest themselves in the matter; and, third, that such recommendations and suggestions as the Association may be pleased to issue would prove a material aid to state and other boards of health, in stimulating and unifying legislative procedure for the protection of public health.

The following general statement of principles, and of rules of practice for obtaining the specific hygienic results your committee seeks to secure, are, therefore, made for your consideration, and for such modification as shall in your judgment make them most serviceable and effective for their intended purpose. They are offered in the hope that the Association will, during the present session, give the matter the attention necessary to put its convictions and aims in the matter of car sanitation into clear and usable form.

GENERAL STATEMENTS.

1. Among the traveling public are some, and in the aggregate many, who are afflicted with contagious disorders which may be communicated to the well through emanations transmitted as microbic dust and conveyed through the air, either directly from person to person, or after lodgement and short or long retention on surfaces or in textile fabrics.

The well, whenever in close proximity to, or confined with, those who are ill with communicable diseases, or who occupy uncleansed apartments previously occupied by such sick, or who use unsterilized or otherwise inefficiently treated bed-clothing or drapery previously used by them, are exposed to a preventable danger. So also are those who are furnished with unwholesome drinking-water or foods.

Air, through its capacity for floating and carrying vaporous and minute solid material, is one of the principal vehicles by which disease is transmitted from the sick to the well. The greater the air-supply furnished breathers the more the disease emanations are diluted, and the less dangerous the air and its contents become to the breather, and the more vigorous the latter's vitality is made by the abundance of air furnished and the consequent purity of the air breathed. The less the air supply, on the other hand, the greater the concentration of the microbic dilution, the lower the breather's vitality, and the greater his danger becomes.

2. The more absorbent, porous, rough, recessed, fluted, carved, or shelf-like the material or the surface exposed to air to any degree laden with microbic dust, the greater the amount of such floating material absorbed or lodged and held by them, to be dislodged and again floated whenever or however sufficiently disturbed. Hence the advisability and sanitary necessity of furnishing no avoidable harbor for the retention of dust.

3. Car sanitation, simply stated, is car cleanliness; cleanliness of the car itself and of its contents—including the furnishings, its air, and its supply of water and food. As the most dangerous poisons are those which are tasteless, so the most dangerous dusts or dirts are those which are not visible. It is because of the invisibility of danger that it is too often disregarded as imaginary, and the counsels of the benefactor, to whom the things unseen are the real, are scouted as the alarms of a dreamer. The emphatic trend of modern pathology is toward what may be termed the microbic or zymotic origin of all contagious disease, the dust or dirt origin, as it might be called; the invisible but dangerous dust in air, on clothing and furnishings, in water and foods.

Car sanitation, therefore, affects the building and the furnishing of cars, their ventilating and cleaning,—the water and food supply.

RECOMMENDATIONS.

1. *Passengers Known to be Ill with Contagious Diseases.*

When a passenger is known to be contagiously ill, he should be isolated in a compartment, appropriately equipped, and thoroughly ventilated in a manner to atmospherically separate it from, and to protect, the rest of the car. Through cars or trains should be pro-

vided with sick-rooms, as well as state-rooms, interchangeable in use, if necessary, and for the use of which charge may properly be made proportionate to the service rendered to the individual and the public.

2. *Construction of Cars.*

The interior of passenger cars should be finished with hard, smooth, and polished surfaces. All surfaces should be smooth and plain. Carvings, mouldings, groovings, flutings, and all so-called ornamental work which furnishes lodgment and harborage for dust and dirt, should be avoided.

3. *Furnishings.*

The furnishings of floor, seats, windows, draperies, should be as non-absorbent as practicable. Wherever admissible, carpets and mattings should give place to impervious material; for plush in seat and seat-backs some impervious material should be substituted; curtains of suitable non-absorbent material should be used, rather than slatted blinds in windows. Floor coverings, seats, draperies, and window curtains should all be made easily removable for cleaning.

4. *Ventilation.*

Coaches should be furnished with effective means for continuously supplying not less than 1000 cubic feet of warm air an hour for each chair or other single seat with which the car is provided, and for distributing and removing the air in an effective manner for doing ventilating work without troublesome draught.

5. *Temperature Regulation.*

The artificial temperature of the car should be so controlled either manually or automatically as to prevent the debilitating effects of over-heating, and the still more harmful effects of chill, or of wide range temperature fluctuations.

The excessive summer heat of cars brought from yards to be made up into trains should be mitigated as much as practicable by shedded yards, protected car roofs, open deck windows and also side windows while the cars are in the yard; or, if need be, by sprinkling the car roofs.

6. *Car Cleaning.*

The cleaning of cars should be frequent and thorough, and without much, and certainly not exclusive, reference to evident dirtiness, since danger from this cause cannot be safely gauged by dirt quantity, nor indicated by its conspicuity.

The cleaning of all removable furnishings should be done outside the car, and, when weather conditions permit, all other cleaning should be with wide open windows and doors.

The feather duster should be used only with open windows, and for the purpose of lifting dust so that it may be removed by a strong through current of air.

Under ordinary conditions interior dusting should be done by means of dampened cloths.

When the cars are in transit and occupied by passengers any method of cleaning which stirs up and floats the dust from the floor or furnishings should be prohibited. The brushing of floor or carpets with whisk brooms, the brushing of clothing in the open car, the porter's manœuvring for a tip, should be discouraged.

7. *Disinfectants.*

Floors should be washed frequently with suds and an added disinfectant of simple, odorless and effective nature. The sanitary and lavatory fixtures should be similarly and frequently treated with a disinfecting wash.

8. *Sterilizing Treatment.*

Thorough cleaning of all fabrics by beating, air blast, dusting, airing and washing should be supplemented by occasionally subjecting the entire interior car and contents to disinfectant treatment by sterilizing gases, vapors or fumes, and by methods of recognized efficacy. Such treatment should be followed whenever any known or suspected case of communicable disease is found among the passengers, and periodically, even though such cases do not appear.

All bedding, including mattresses, pillows, blankets and curtains should be similarly treated, being always thoroughly aired and otherwise cleaned after each use, and sterilized promptly after exposure by a suspected or known case of contagious disease.

All bed and lavatory linen should be thoroughly sterilized in the process of laundering.

9. *Excreta.*

The practice of disposing of excreta by scattering it over roadbeds is both dirty and dangerous—alike to the passenger and to the public. Such material on drying contributes to the dust of the road and in the cars, and becomes part of the floating contents of the air of the cities and the country through which the roads run. Convenience in disposal affords no adequate excuse for the maintenance of this slovenly, filthy and dangerous practice. Sewage tanks and earth closets should be provided under the cars.

10. *Water and Ice Supply.*

Water and ice should be obtained from the purest available source, and none should be used from any source which has not been proved by reliable tests to be safely free from harmful contents. If natural water and ice of such quality cannot be obtained, then the water

should be treated by the most appropriate and effective method for its purification, and ice should be artificially made from such purified water.

Ice should no more be handled by bare and soiled hands or by dirty gloves than drinking water should be poured over such hands or gloves into the water holder. The use of ice tongs should be insisted upon.

11. *Water Tank.*

The water tank should be shaped and placed with reference to easy access to its interior for cleaning. It should be frequently cleaned and periodically sterilized with boiling water or otherwise.

12. *Drinking Cups.*

The public should be discouraged from using common drinking cups, and educated to use individual cups. To this end, a conspicuous notice might well be posted at the drinking fountain cautioning passengers against the danger of the public cup, and parafined paper cups might be supplied by a "cent-in-the-slot" device.

The vertical jet method of furnishing drinking water—in successful use in some public buildings in this country—is the safest conceivable and the best, aside from the difficulty of adapting a jet to all ages, and from the waste incident to its use by many unaccustomed to drinking water jetted into the mouth.

13. *Food.*

The use of canned goods in buffet car service makes careful inspection of such goods imperative. Reports of sickness directly traceable to tainted canned edibles served on trains have occasionally reached your committee. Fruits and all edibles should, before and after purchase, be stored with care to avoid all unnecessary exposure to street and car dust.

14. *Fouling of Cars.*

Cars should be protected against all unnecessary fouling. The filthy habit of spitting on car floors should be dealt with in a manner to cause its prompt discontinuance. The nastiness should everywhere be made punishable, and should be punished as one of the most flagrant of the thoughtless offences against the public right to health. Prohibitory notices should be posted in all cars, and suitable and sufficient cuspidors should be provided for the use of passengers. The experience of street car companies has shown that a great reform can be wrought in this matter without serious difficulty.

15. *Station Premises.*

Station premises should receive attention directed to general cleanliness of floors, furnishings, air, sanitaries, lavatories, platforms and approaches, and should be plentifully supplied with approved disinfecting material, and with pure water, and safe means for drinking it.

SUPPLEMENTARY REPORT ON CAR SANITATION.

By Dr. DOMINGO ORVANAÑOS,

Member of Superior Board of Health, Mexico, Mex.

The Committee on Car Sanitation has for several years attempted to demonstrate the facilities which exist in railroad cars for the transmission of contagious disease. It has cited several cases in which that transmission has taken place and has given details of the ways in which that transmission occurred. It has brought to the knowledge of the local boards of health within the territory of the Association, the railroad companies and the general public, the objections and difficulties that these cars now present to public health, especially the sleeping cars, as well as the total or almost total absence of care as to their heating and ventilation, supply of really pure water, disinfection of the cars and of the objects that are subject to contamination, especially the bed clothes, towels and toilet articles, and has also shown the necessity of sterilizing the expectorations and the methods for doing so. The committee has investigated the precautions that are taken by the railroad companies to avoid the transmission of these diseases, and has repeatedly sent them circulars, giving details of the methods that ought to be employed to prevent this transmission.

In spite of all this, nothing has as yet been done, generally speaking, to change in any way the style of the railroad cars. Things remain in the same condition as formerly, and the danger to the traveling public increases every day. The investigation of the principal causes of this condition of affairs, and the pointing out of the most obvious remedies that ought to be recommended for the correction of these evils, is the object of the present paper.

In my opinion, there are three causes that have prevented the sanitation of the railroads, and they are the following: Firstly, the difficulty of deciding many of the problems that are included in this important question. Secondly, the indisposition of the railroad companies to undertake the expenses implied in such a reform, and thirdly, the toleration of the public, and I might add the ignorance on its part, with respect to the serious injuries that these evils might cause to the public health.

Amongst the most important and most difficult of all these problems, is the ventilation of the cars, at least as regards this country, because in the Mexican Republic, where we do not suffer from

severe winters except in a narrow zone on the northern frontier, and even then during a very short time, the problem is very much simpler, as we can travel with several windows of the car open both day and night, and by that means produce an almost constant renewal of the air. In the northern part of this continent, where the cold is excessive for several months, the renewal of the air, or what amounts to the same thing, the preservation of its chemical properties, can only be obtained with detriment to the physical qualities which that air ought to have, in order not to inconvenience or produce disorders in the system. The largest sleeping cars that I know have no greater capacity than eight cubic meters per person when they are full, whilst man really requires thirty-two cubic meters of pure air per hour. The complete renovation of the air in the car has to be carried out, therefore, four different times in an hour, and during winter this causes such a lowering in the temperature that it cannot be supported. These cars, with a capacity of eight cubic meters per head, are furnished with twenty double berths, and it is very possible that some of these beds may be occupied, on some occasions, by two persons, and this would require the renovation of the air as many as five, six and even eight times per hour in order to comply with hygienic requirements.

Different schemes for the ventilation of cars have been brought before the Association almost every year, in which some defect or difficulty has afterwards been found, and I have not as yet been able to hear of any one of them being generally adopted. It is possible that later on we may reach the conclusion that there is no way of furnishing pure air of good physical and chemical qualities, whatever may be the means employed for that object, when human beings are crowded together in the inconsiderate manner that we now constantly see.

On the other hand, if we reduce the number of persons to be admitted in the railroad cars for a given space, the prices for passage and berth would become excessive as compared to the present rates, and this would redound to the injury of both the public in general and the railroad companies.

We have already said that the railroad companies do not find themselves disposed to undertake the expenses which are required for the sanitation of the cars, and this certainly must be the case, because they do not see where they are to obtain any compensation or pecuniary profit from such reforms. Whenever one of the more important railroad companies undertakes to introduce these reforms to their fullest extent and establish perfect sanitary conditions in the car, finding its sacrifices compensated by an increase of passengers,

it will then consider its sacrifices and disbursements well employed, and present an example to be imitated by other companies.

The tolerance of the general public and the ignorance that largely prevails as to the injuries which the public health may suffer through the bad conditions of the railroad cars, have not as yet had any influence in raising a unanimous cry of horror and indignation, which sooner or later will come, whenever the public properly understands the irreparable injuries that are caused and that could be prevented at only a slight cost. I believe that the time is not far distant when the public will assert its unquestionable right to be afforded protection for its health and life, and when the sanitary authorities and railroad companies will comply with one of those duties, that with the modern advance of the science of bacteriology, can in no way be set aside.

There is a Spanish proverb which says, that the best is the enemy of the good, and treating of the question of railroad car sanitation, we have been so anxious to study it and to reach the best, that unfortunately we have been unable to obtain even the good. Why should we not confine ourselves for the present, to the bringing into practice of those more simple means, more feasible, more certain and less costly, and that will serve to remedy the most serious and frequent danger; I think that the boards of health in the territory that is covered by the Association, ought to try to obtain authority from the different legislatures, to make the following provisions obligatory on the railroad companies:

1st. The isolation in special cars of any person suffering from a transmissible disease.

2d. A supply of properly guaranteed filters in the tanks of drinking water.

3d. The disinfection in properly arranged furnaces of all the bed clothes, hangings, curtains and towels.

4th. The provision of all sleeping cars with small disinfecting stoves for small toilet articles.

5th. The absolute prohibition, under severe penalties, of expectoration on the floors.

6th. The provision of all railroad cars with a sufficient number of cuspidors containing a strong disinfecting solution.

REPORT OF THE COMMITTEE ON THE POLLUTION OF PUBLIC WATER SUPPLIES.[1]

Mr. President and Gentlemen—Since 1894 your Committee on the Pollution of Public Water Supplies has devoted most of its efforts to matters of an analytical nature. From the beginnings then made, and with the aid of a large number of laboratory workers, there have resulted the publication of a Report on Bacteriological Methods, which is widely used in this country and well thought of abroad, and the establishment of a Section of Bacteriology and Chemistry. The analytical phases of water pollution problems having been delegated to committees under this section, the present committee returns to topics of a more general nature.

It was decided by this committee that, for the present meeting at least, our report should take the form of records and summaries showing recent progress in the more important branches of the subject assigned to us. Accordingly, a series of topics was allotted to the individual members for the preparation of the available evidence; and the general report presented herewith consists of a summary of the material accumulated in this manner.

The President and Secretary of the Association requested this committee to take steps to bring out a thorough discussion of this general subject from the standpoint of the engineer, the analyst and the health officer. This request has been complied with so far as practicable.

I.

WHAT CONSTITUTES A SATISFACTORY WATER SUPPLY IN THE LIGHT OF OUR PRESENT KNOWLEDGE?

Expressing in brief terms the leading features of Mr. R. S. Weston's paper, it may be said that the modern water supply must provide under adequate pressure a sufficient quantity, to meet liberally all legitimate use and unavoidable waste, of water which is either originally pure and wholesome, or which has been rendered so by some process of purification. With regard to quality, the water supply of the future should meet the following requirements:

a. It shall be free, or substantially free, from disease-producing germs.

b. It shall be clear and colorless, or nearly so, containing no objectionable turbidity or vegetable stain.

c. It shall be free from objectionable tastes and odors as supplied to the consumer.

[1] Presented at the Indianapolis meeting October 24, 1900.

d. It shall be free from noticeable amounts of dissolved iron, such as unfit it for household use.

e. It shall be free from excessive amounts of lime and magnesia, such as make a water too hard for ordinary use.

f. It shall be carefully examined with regard to constituents capable of dissolving metals used in distributing pipes, and this information in connection with the pipes employed should result in such steps as necessary being taken to guard against complications of this nature.

To many of you these brief facts will seem trite. It will appear that they represent what has been sought by the foremost sanitarians and water works men for years, and, if not obtained in practice, it has been because the actual results accomplished in many places have been limited by financial or other important local consideration. In a measure your committee recognizes this fact, but it desires at the same time to point out that recently there has been a marked change in public opinion in this respect. Many water supplies which were apparently satisfactory ten or fifteen years ago are unsatisfactory to-day; and there are supplies which are claimed by municipalities to be suitable now which will not be so ten years hence.

In presenting to-day for your consideration and discussion a progress report upon this important topic, it is not the desire of this committee to see the time occupied in an exact definition or specification of the ideal or thoroughly satisfactory water supply. This general information is so well known to you all that further details are unnecessary. It is the hope and intention of the committee, however, to see the discussion focus upon the actual issue of the day, namely: How nearly must the future water supply approach the ideal in point of quality, in order to satisfy the modern water consumer, and what are the recent advances which have been made towards securing this end?

It is very gratifying to be able to state that substantial progress has been made since a general survey of this topic was last made to the Association. The progress may be divided into two distinct classes. The first relates to changes in public opinion as to the character of water which consumers are entitled to receive. The second is connected with improvements in physical processes necessary to satisfy the demands of the more intelligent citizens.

At the present time there is a considerable portion of the inhabitants of the various centers of population which recognizes clearly that they are entitled to a water supply which shall not transmit to them water-borne diseases. A smaller proportion of water consumers, but aggregating numbers far greater than most people realize, considers that a water supply should also present a first-class appearance with regard to freedom from turbidity and discoloration from

iron and vegetable stains. In support of this advance in public opinion, it is only necessary to point to the fact that within the past ten years over forty of the larger American cities have given active consideration to the improvement of their water supplies, chiefly on the ground of quality. Another fact which speaks volumes in itself is the growing custom among the better class of water consumers of attempting to improve the quality and appearance of the supply by the purchase of water from pedlars, or by household filters, or both. When this rapidly-growing class of water consumers reaches an effective majority in their respective communities is the time when it will be imperative that the quality of water supplies shall equal or approach very nearly to the ideal as noted above. The present trend of affairs, however, indicates that in a great many instances this date will be discounted by water works officials in their desire to maintain public works in touch with the best thought of the times.

Until quite recently water works officials answered criticisms concerning the quality of their supplies by the legitimate statement that it was impracticable for them to secure a supply which, in its natural condition, was perfectly satisfactory, and that there was not enough information concerning purification processes as to cost and efficiency to justify large expenditures. The truth and significance of this statement with reference to supplies of unpolluted, clear and colorless water, will increase each year. With regard to methods of water purification, the day has gone by when this statement alone can properly be made. While the original water should be as free from sewage pollution as practicable, it may be definitely stated that it is now possible after study of local conditions to purify almost any water in a satisfactory manner, and at a reasonable cost, although some waters are of such a character as to make their use inadvisable when other supplies can be found. The special field of water purification is discussed beyond. But it may be added here that the total cost of purification ranges ordinarily under different local conditions, only from about 20 to 50 cents per capita per annum, a mere fraction of the cost of spring water and other waters now freely bought from private sources. The range in cost is largely due to differences in the amount of water which is illegitimately wasted. In fact, the needlessly large consumption of water in most American cities is one of the chief drawbacks to improvement of the quality; and the sooner public opinion assists in restricting the waste, the sooner will the consumers have better water.

In brief terms it may be said that the current evidence indicates that as a general rule the surface waters for the future supplies of this country should be taken from as unpolluted sources as practicable, and should be properly purified (including clarification and decolorization); that excessively hard waters should be softened,

and that ground waters should be freed from dissolved iron if present beyond slight amounts.

II.

ON THE VALUE OF VITAL STATISTICS AS AN INDEX TO THE POLLUTION OF WATER SUPPLIES.

Twenty years ago it was considered that the chemist, after making a few analyses, could render a positive and unqualified decision as to the hygienic character of any water. In making his decision he was usually aided more or less by a series of arbitrary standards of purity, based on evidence from a limited number of types of water. With the advent of the germ theory of disease and the new science of bacteriology, the position of the water chemist became less autocratic. There followed a period of doubt in the minds of many, due in part to the added knowledge coming from a wide range in the types of natural waters.

At present it is to be stated that the modern water analyst should be skilled in the application of both chemistry and biology. Apart from the very important role which he is destined to play in the future with reference to purification processes, it may now be said that, after he has secured the needed analytical data, he can tell definitely whether the quality of a given water for domestic use is very good or very bad. With regard to that large intermediate class, conventionally called "suspicious" waters and which may be used with moderate safety for years, or which, without warning, may cause a typhoid fever epidemic at any time, the position of the analyst is far less sharply defined.

Leading sanitarians agree concerning suspicious waters that, while the work of the analyst is important, final conclusions should be based not on his data alone, but in conjunction with the results from sanitary surveys of the source of supply and with the vital statistics of the water consumers.

The value of vital statistics in this connection is clearly stated in the paper by Dr. A. C. Abbott, who concludes that "Of the data relating to suspicious water supplies, that which is the most trustworthy and constant in its indications are the regularly recorded vital statistics of the community using such water."

III.

COMPARATIVE STATUS OF THE WATER SUPPLIES OF THE LEADING AMERICAN CITIES AS SHOWN BY TYPHOID FEVER STATISTICS FOR THE LAST TEN YEARS.

These valuable data are frequently sought for by sanitarians in connection with various studies. Although many of the records have been compiled in various publications, it is usually difficult in many instances to bring them up to date without considerable time

and labor. It is thought by the committee that it would be well to establish the custom of including in our reports each year complete records as a matter of reference of typhoid fever rates for leading cities from 1890 up to the current year, as far as practicable.

This time-consuming task has been undertaken for the committee by Prof. J. J. McKenzie, who has sent out circular letters to secure these data for all cities of over 10,000 population. This information in apparently satisfactory form has been obtained for the cities in the States of Massachusetts, Rhode Island, Connecticut, New York, New Jersey Pennsylvania, Ohio and Michigan, as well as for quite a number of the larger cities in other States. Delay in securing the returns of the recent census makes it impracticable to present this evidence today, although it will probably be in readiness to be included in the forthcoming annual publication of the Association.

IV.

ON THE CONSERVATION AND CONTROL OF WATER SUPPLIES BY STATE, PROVINCIAL AND MUNICIPAL AUTHORITIES.

This general topic is a very broad one, and one of the most important coming before the Association for consideration. Under present arrangements there is some uncertainty as to how the subject had best receive the attention which it deserves. This is largely due to the fact that it relates to the work of several committees, notably that on Public Health Legislation.

To the thought of your Committee on the Pollution of Public Water Supplies, it would be very desirable to make this topic the subject of special discussion at the next meeting of the Association, and it herewith makes recommendations to that effect. The most suitable manner in which such a discussion could be taken up is a question which requires attention.

This committee has devoted some time to the collection of evidence upon this subject, to serve as a matter of reference and also to facilitate discussion to-day and at your future meeting. The evidence, so far as is available, is presented by Dr. F. F. Wesbrook.

V.

ON THE RELATION OF THE ANALYTICAL LABORATORY TO PROBLEMS IN THE POLLUTION OF PUBLIC WATER SUPPLIES.

Ten years ago the analytical laboratory for a number of reasons occupied a rather uncertain position with reference to water pollution problems. So far as systematic work was concerned, it was then confined largely to the labors of the State Boards of Health of Massachusetts and Connecticut, although analytical data on special problems were obtained by various authorities from time to time, and the water supplies of a few of the large cities were analyzed quite regularly.

Since 1890 there has been a rapid advance in the amount of analytical data secured each year, relative to problems in water supply and sewage disposal. This is especially true with regard to purification plants and processes and various special problems. At this time it is gratifying to note that there is a growing appreciation of the value of analytical data, and that the true position and scope of laboratory work is being more correctly understood. During the past ten years there have been established more than twenty new laboratories in this country, in which the analysis of water and sewage forms a prominent feature. Further, there is a growing number of State and local authorities which avail themselves frequently of private laboratories and those of educational institutions.

The details concerning the growth and the present relation of the laboratory to this line of work will be presented by Dr. Wyatt Johnston.

VI.

ON THE LEGAL ASPECTS OF WATER POLLUTION.

Each year sees an addition to the accumulating evidence upon the legal aspects of water pollution. To many sanitarians and water works men this is a subject which presents to them considerable interest from time to time. It is the intention of this committee, as time allows, to present in condensed form the leading features of the more prominent court decisions in this connection. The purpose of this will be principally for reference, rather than for detailed discussion.

Beginnings toward this end have already been made by Dr. J. L. Leal. At this time, however, there is little to be said, in the form of a summary, with regard to general progress in this direction.

VII.

SUMMARY CONCERNING SEWAGE PURIFICATION PLANTS NOW IN OPERATION IN AMERICA.

It appears that there are now in operation in America several hundred sewage purification plants, ranging in size from those for cities of more than one hundred thousand inhabitants down to those for small institutions and summer hotels. With regard to the larger ones the available information indicates that there are about seventy-five which treat the sewage of about five hundred persons or more. Many of these plants were installed to reduce the pollution of public water supplies, while a large number are operated with the view to obviating nuisances, such as would arise from putrefactive changes in the bodies of water into which the effluents are discharged.

More or less information of a general nature concerning many of these plants is available, through official reports and articles in professional and technical journals. Detailed specific information upon

various points of importance, however, is for the most part confined to the larger plants in Massachusetts which have been examined by the Board of Health of that State. Compilations of the leading published information available from the larger plants have been made by your Chairman, supplemented somewhat by personal inspection and by correspondence. While as yet the amount of directly comparable data is too meagre to warrant a detailed presentation, yet these comparisons bring clearly to light a number of points of general interest and of suggestive value. Some of them will be noted, to facilitate your discussion to-day.

The point upon which our knowledge has been most advanced, through data coming from sewage purification plants in actual practice, seems to be the composition of sewage. For years it has been known that the composition of all sewages varies widely at different times, and that American sewages are much more dilute than those abroad. It is the amount of suspended organic and mineral matters in a sewage which usually gives the best index to its composition with reference to purification. The reasons for this are that suspended mineral matter becomes a sludge which after greater or less accumulation requires removal by physical means at considerable expense; while the suspended organic matter is the chief factor of difficulty in processes for thorough purification, from the standpoint of both cost and efficiency. There are at least twelve places in this country where such information has been obtained with sufficient frequency to yield results which may be used as approximate averages. As a matter of reference, these results, taken from the reports of the State Boards of Health of Massachusetts and Connecticut, are given in the following table, beyond which are corresponding results from European sewages:

Record of Average Suspended Matters in Some American Sewages.

(*Parts per Million.*)

Place.	Years.	Total.	Mineral.	Organic.	Per cent. which organic is of total.
Brockton, Mass	'97-'98	120	23	97	81
Chicago Exposition	'93	182	29	153	84
Framingham, Mass	'93-'98	1364	154	1210	89
Gardner, Mass	'93-'98	134	31	103	77
Lawrence, Mass	'88-'89	240	102	138	57
Leicester, Mass	'97-'98	106	25	81	77
Marlboro, Mass	'92-'98	201	53	148	74
Medfield, Mass	'94-'98	107	26	81	76
Meriden, Conn	'97-'98	120	38	82	68
Natick, Mass	'97-'98	23	12	11	45
Spencer, Mass	'98	95	13	82	87
Worcester, Mass	'93-'94	212	99	113	53
Total average	.....	240	50	192	79
Ditto, except Framingham	.....	140	41	99	71

RECORD OF AVERAGE SUSPENDED MATTERS IN SOME EUROPEAN SEWAGES.

(*Parts per Million.*)

Place.	Authority.	Total.	Mineral.	Organic	Per cent. which organic is of total.
Average of 16 English water closet towns.	River Pollution Com..	447	242	205	46
London, '94	Dibden	450	....	....	....
Sutton, '99	Rideal	609	....	....	....
Leeds	City Document	531	....	....	....
Accrington, '99	Naylor	505	205	300	59
Danzig	Koenig	582	226	356	60
Berlin	Koenig	1085	383	702	65
Breslau	Koenig	405	205	200	49
Haller	Koenig	594	189	405	68
Frankfurt	Koenig	1193	387	806	67
Leicester, '98-'99.	City Document	624	....	....	....
Salford, '92	Vogel	512	144	368	72
Cassel	Hoepner & Paulmann.	5460	1246	4214	78

With regard to the fundamental principles which control the operation of plants in practice for the purification of sewage by irrigation or intermittent filtration, the most comprehensive statement which can now be made is to the effect that the available evidence, so far as it goes, testifies to the soundness of the laws which were formulated at the Lawrence Experiment Station. In fact, there are some indications that somewhat better results may be expected in practice than have been obtained from the experimental filters, other things being equal.

For a high degree of purification of sewage entering small, short feeders to public water supplies, there is no evidence to indicate that this can be accomplished in a better manner than by intermittent filtration. The cost of this treatment depends largely upon local conditions. Where ample areas of suitable land are readily available at a low cost, as is the case in many places in New England, first-class results can in most cases be obtained at the least cost by this method in its simplest form. But where suitable land is very scarce and expensive, or where filters would have to be built of selected material brought from a distance, the indications are that economy demands that the sewage receive a preliminary treatment, so as to allow higher rates of filtration. Such preliminary treatment relates of course to clarification of the crude sewage, or, in other words, to the removal of the suspended matters which exert such a troublesome clogging at the surface of the filters.

Much study for many years has been given to the clarification of sewage as a preliminary step in its purification, and the problem is still an open question. During the past few years the so-called septic tank system has been much talked about in this connection. Although this procedure is being tried on a greater or less scale at ten or twelve different places in this country, comparatively little is now

known in definite terms concerning its practicability under various known conditions as to the sewage treated and details of devices employed. Opinion as to its merits is widely at variance. Some appear erroneously to regard it as a complete purification process in itself. Many consider it a successful solution of the difficulty of final disposition of matters suspended in sewage. Others seem to question its practicability on the basis that there will be a large accumulation of sludge in the septic tank, involving much expense for its removal as well as nuisances due to bad odors.

Whatever the future may show to be the true merits of the septic tank, it is certain that it can never afford a final disposition for the suspended mineral matter in the sewage, although it may possibly facilitate this step. This is a point of much significance, as the mineral matters form from 20 to 40, and sometimes 50, per cent. of the solids in suspension.

With regard to filtration of sewage at comparatively high rates, to secure moderate purification for cases where the effluents are very indirectly or not at all connected with public water supplies, there is very little evidence from actual operations in this country. In general terms it would appear that success in this important field will be associated to a considerable degree with the freedom from suspended matters in the sewage as it reaches such filters. It is felt that much more information is needed in this branch of work before large plants can be built with confidence as to permanency and economy.

ON THE PRESENT STATUS OF METHODS OF PURIFICATION OF WATER SUPPLIES, WITH A SUMMARY OF PLANTS IN OPERATION IN AMERICA.

Of the various branches of public works connected with the pollution of water supplies, there is none in which such substantial progress has recently been made as in water purification. Ten years ago our information upon this subject was very meagre, and comparatively few plants were in operation. During this period English sand filter plants have been increased from about 1.5 to 19 acres, with respective nominal capacities of about 4 and 57 million gallons daily; and the American, or mechanical, filter plants have been increased from about 12,000 to 90,000 square feet, with respective nominal capacities of about 36 to 270 million gallons daily. Projected plants for some of the largest cities in the country show that in the next few years there will be very rapid development in the application of both of the leading methods of purification.

Concerning the large fund of technical knowledge relative to the efficiency and cost of water purification which is readily available from various books, reports and professional and technical journals, it is needless to touch upon them in this report of progress. An adequate statement of the general situation at this time will be found in the paper by Mr. Allen Hazen. With regard to the leading generali-

zation which can be made at this time, leading workers in this subject agree upon the following:

1. Of the various processes mentioned for the purification of water supplies, there are two general methods which have shown distinctly their practicability, namely, the English method of slow sand filtration, and the American method employing rapid mechanical filters.

2. Each of these methods has its distinct advantages for particular cases, as well as its disadvantages for others; and there is no doubt that each has a large field of usefulness.

3. For those waters which never possess more than a slight or moderate amount of turbidity or dissolved vegetable color, the English method of sand filtration is somewhat more efficient; and as a rule it is slightly the cheaper for such waters.

4. For those waters which for long periods at a time contain excessive quantities of either finely divided clay or of dissolved vegetable matter, there is now no practicable method of purification without the use of coagulants and subsiding basins. It is the consensus of opinion, however, that coagulants should not be employed where it is practicable to secure satisfactory results without them.

5. While coagulants can be successfully used in connection with the English method of sand filtration, in those cases where coagulants are imperative, the American method, as a rule, yields somewhat more efficient and economical results.

6. Many of the purification plants now in operation in this country have not shown as high efficiency as is reached by a few of the better ones, and as may be expected from those now about to be built. This is due in part to their construction, and in part to their management, the latter point applying particularly to mechanical filters.

7. While there has been rapid progress in the past few years in discovering the controlling laws of purification and in the establishment of certain types of filters, there are indications which go to show that material progress and improvement may be expected for some time to come.

CONCERNING RECENT PROGRESS IN EUROPE IN MATTERS PERTAINING TO THE POLLUTION OF PUBLIC WATER SUPPLIES.

This broad field is so well covered in the most important points through various reports, books, and journals available to the members of the Association, and is so well known to many of you through recent visits abroad, that there is little to be said at this time by your committee.

Several members of this committee, however, have been interested in securing information relative to the present governmental control of water pollution in Europe, and the procedures employed in accomplishing practical results. A summary of this information will be reported upon at a future meeting.

With regard to water purification in Europe, the most striking feature is the efficient manner in which the plants are operated. This is due in part to the long experience, with each particular water, of technically competent men; and in part to the scientific control and supervision both on the part of the water works officials and of other authorities.

European experience in water purification covers a much narrower range in types of water than has been carefully investigated in America, and can supplement but very little the leading evidence now available in this country. Concerning the purification of waters highly charged at times with algæ and similar growths, the present evidence is almost wholly confined to European experience.

The subject which, of course, is of most interest to the greater part of American sanitarians relates to recent developments in England with septic tanks and high rate filters in the purification of sewage. To a majority of Americans who have made personal inspections at leading English cities, it would appear that developments are rather disappointing, and still lacking in thoroughness in some essential features. To the thought of some of the foremost sanitary engineers in England it is yet too early to conclude that the past ten years have shown any substantial improvement in England in methods of sewage disposal. The majority of English sanitarians take a far more hopeful view than this, and consider that rapid progress has recently been made, especially in our knowledge of the underlying principles of bacterial purification. It is difficult, however, to ascertain in precise practical terms in just what this progress consists, in view of the widely varying types of procedures which have been projected for several of the larger English cities. In this connection it is of interest to note the position of the Local Government Board. As many of you know, plans for sewage disposal are normally presented in England to this board for approval, in order to secure authority for the loans needed to cover the cost of construction of new works. While this board has approved a number of plans embodying new types of purification processes, it has in every instance, so far as we know, insisted that the loan be increased to cover cost of land treatment to follow, if needed, treatment by the new processes. In the opinion of a majority of English sanitarians this qualification is needlessly burdensome. Notwithstanding, very recent developments indicate that the board will hold its position until it receives for its guidance the report of the Royal Commission appointed last year to investigate the new processes.

It is to be added that it is possible to circumvent the direct approval of the Local Government Board by means of a special act of Parliament, although the board still exerts its influence through committees. This procedure is expensive, and is prohibitive for this reason for the smaller cities. A number of the larger cities, however, are availing themselves of this step.

Summing up in brief terms the present English evidence upon new processes for sewage disposal, it may be said that while it shows many promising features, it is not yet sufficiently definite and exhaustive to allow final conclusions to be drawn.

GEORGE W. FULLER, Chairman.
W. JOHNSTON.
J. L. LEAL.
A. C. ABBOTT,
ALLEN HAZEN.
L. P. KINNICUTT.
J. J. MACKENZIE.
F. F. WESBROOK.
R. S. WESTON.

REPORT OF THE COMMITTEE ON DISPOSAL OF REFUSE MATERIALS.

By Mr. RUDOLPH HERING, New York City.

Mr. President, and Gentlemen—After a very careful collection and study of a great deal of information, and after well-considered conclusions, your committee made a report on this subject three years ago. The conclusions, however, did not entirely clear up the subject because the information at hand was still insufficient to do so. No further report has been made since then, and it was thought that at this meeting a report of progress might be *apropos*.

In the United States a number of crematories have since been established, with more or less success. The one in San Francisco may be considered the largest, and an inspection of the same about a year ago did not give the satisfaction that was expected of it by the promoters at the outset. The reason for this may be gathered from our report among those given as effecting the success and failure of most of the works not only in this country, but also in Europe. Another furnace has been carefully observed, namely, that in Montreal, which your committee in its last report spoke of as being the best type that was yet in operation on this side of the Atlantic. Some interesting experience has been had there. It was found necessary to make some changes, consisting of the abandonment of some new ideas that had there been introduced, resulting in a step back towards the English furnace, after which this had been modeled.

Quite recently another change has been made, namely, in a separation of the refuse material. I may say, that in Montreal all of the refuse, ashes, garbage, street sweepings, and rubbish of all kinds have been brought to one furnace and there burned. In winter they could not destroy as much material as in summer, for the reason that a great deal of ashes with fine dust would not allow the furnace to burn as well, and the sifting process, which has been attempted in many cases, did not seem to be satisfactory, or, at least, not sufficiently economical. So, recently, the city council passed an ordinance which requires that the ashes be kept clean and separate from all of the other refuse and disposed of by dumping at some near point; whereas all the other refuse, garbage, straw, sweepings, etc., should be taken to the furnace and burned.

With reference to reduction works, we have also seen a slight change from the status recorded in the report of three years ago. In

New York, where we have the largest reduction works, there has recently been a complaint made of the odors emanating from these works, and at Albany, at the last session of the legislature, a law was passed to abolish them, at least, at that point, and at the present time the matter is in court. I also understand that specifications have been prepared and may be issued any day for new bids to dispose of the refuse material in New York, and I understand that the bids will be asked for in different ways; one, for destroying the kitchen garbage by fire; another one, for destroying it together with all the combustible refuse, such as box straw rubbish, and the like; and still another bid for a continuation of the present reduction system.

Since our last report, we have had some reduction works erected in Boston according to a similar plan and with some slight improvements over what we have in New York City. I understand that here also complaints have been made, and it is questionable whether these works can remain where they are, notwithstanding they are at least a mile from the built-up portion of the city, and adjoin the gas works and sewage pumping works of South Boston.

In Europe, as we have already stated, the only method of disposing of city refuse is by cremation. In Paris no settled process has yet been introduced. Marquis Bonardi was about to start an experimental utilization plant last September. In Berlin, where some excellent experiments have been made, reported by us three years ago, they are still experimenting, because the refuse is of a peculiar kind. In Brussels, Belgium, the garbage furnaces are reported to give satisfaction. In England, where there are a great many furnaces, the reports are just about the same as they used to be. In the destruction of such refuse material they are now considering the question of how far they can reduce the expense for a destruction, which question is sought to be answered by an effort to utilize the waste heat. In Shoreditch, England, they are running works to entire satisfaction, burning all the refuse and producing enough electricity to do quite a little work at various times.

In Hamburg, Germany, we find to-day not only the largest, but decidedly the best, plant for disposing of city refuse. It is built on the English plan, and was described in our report three years ago. Your Chairman had the pleasure of visiting these works last summer. The establishment is quite near habitations. The refuse of a portion of Hamburg only is taken there, because the expense of carting is too great to get it from farther parts.

They use thirty-six furnaces in one plant, more than operated in any single plant in England or elsewhere. The garbage is collected and brought to the works in large wagons, the boxes are lifted from

the wheels, carried over to the furnaces, the contents are dumped into the furnaces, the boxes lifted up again, returned to the wheels and cleaned. All this work and much other work about the institution, which is quite considerable, is done by electricity. Some of the ashes are ground, and for several years have been sold as fast as they are made. Also the sewage of a part of the city is pumped by electricity generated at the works. So far as the odors are concerned, there are practically none. The works are in general charge of the city engineer, and very intelligent assistants have immediate charge of them. It is the opinion that the success of these works is due largely to the intelligence of the men engaged there, and that the heterogeneous nature of city garbage makes it a necessity to employ a higher degree of intelligence than the handling of almost any other material, to dispose of it without causing a nuisance. In our country, unfortunately, we think anybody is good enough to shovel this material into the furnaces and to operate the works. That is our mistake. It requires more than ordinary skill to regulate the draughts and to attend to the operation of the furnaces, so that they always work properly.

The question in Europe is not whether we shall introduce cremation works or reduction works, which is the question in this country. It is only, how can we cremate refuse at the least possible expense?

It seems to your committee that the following general statement might be added, in closing this report. The nature of the refuse is so complex that each part should be carefully considered separately as a part of the whole. The various parts or groups are: 1st, kitchen refuse or garbage; 2d, dry refuse, i. e., box packings, straw, etc.; 3d, ashes; 4th, street sweepings; 5th, catch-basin cleanings; 6th, night soil; and 7th, dead animals. Those are the objectionable articles that we must remove from our city, and each one should be considered by itself. Then, if a combination of any of them can be made at a less expense, it is to be recommended. For instance, if it is cheaper to mix the kitchen refuse with dry refuse than to dispose of them separately, then it should be recommended. The whole matter then practically turns on questions of engineering. In finding out which of the available processes is the least expensive, we should divide the investigation into three parts.

First. Ascertain the cost of collection and conveyance of each of the above classes of material to the nearest points of final delivery, according to each process of treating it.

Second. Ascertain the cost of conversion of all of the above objectionable or offensive materials, according to each one of the several processes.

Third. Ascertain the salable value, at the above points of final delivery, of any of the products you may obtain.

By adding the cost of these three items for each one of the processes, the most economical process for that particular city is thereby indicated, and then it will be seen whether garbage should be collected and reduced for the value of its grease, or whether it is better to keep ashes separate and mix the garbage with the dry refuse and burn these two together, or whether we should mix garbage, dry refuse and ashes and burn them together. In short, it is merely reduced to a question of engineering.

In Paris, last summer, at the Congress of Hygiene, a new International Committee was appointed on Street Hygiene. The next Congress meets at Brussels four years hence, and this committee is expected to report at that meeting. The members of the committee were appointed from each country represented: United States, England, France, Germany, Russia, Spain, Italy, etc. This committee will issue a quarterly publication in three languages, and will receive articles on the subject. Its Chairman is Mr. H. Alfred Roechling, of Leicester, England. It is expected that in four years that committee may make a valuable report on the subject of Garbage and Refuse Disposal.

REPORT OF COMMITTEE ON TEACHING OF HYGIENE AND GRANTING DEGREES OF DOCTOR OF PUBLIC HEALTH.

Dr. Wyatt Johnston, Secretary of the committee, explained that the committee was not yet ready with a formal report, though individual members had carefully studied many of the different phases of the subject. It was proposed to allot each of these to some member of the committee specially qualified to deal with it and obtain from each a basis of what might be regarded as the normal requirement in each branch of hygiene. When these were collated and brought before the Association it was hoped that a series of standards of instruction suitable to American requirements would result, and that these would be found of service in securing uniformity in the requirements of health boards, colleges and boards of regents in different parts of the continent.

A SCHEME FOR PREVENTIVE MEDICINE.

By Dr. LEANDER P. JONES, Greenwich, Conn.

When the Spanish war was imminent, very optimistic ideas were rife as to the risk of disease in modern warfare. It was confidently asserted in some of the leading journals, and the names of distinguished men of science were freely used as vouchers for the assertion, that Sanitary Science had made such wonderful advance during the last twenty years as to insure practical immunity from disease for our army, even in a pestilential climate.

Other armies had suffered more from disease than from bullets, but now a great civilized nation would send out an army whose sanitary welfare would be an object lesson to the world. Mothers gave their sons to the service, believing that they would die as heroes, or come back to them in the vigor of manhood, without the dreadful sequelæ that followed our Civil War. Some were wise enough to foresee the disappointment that awaited these expectations, and we all know it now.

Shafter's army in Cuba was reduced seventy-five per cent. by disease that, in theory, is regarded as preventable, a fact that startled and deeply impressed the whole nation. But it is a more startling fact that in the year 1898, the number of children that in New York City alone died from preventable diseases exceeded the number of all the men who were killed or died from disease in the army.

In wartime, our attention is focused upon the lives of men in the field. We read the data, and lament the number of the fallen whose record stands before the world, and, we are righteously indignant if their interests are not duly guarded. But we are careless of those who are falling beside us, possibly through our own neglect.

According to the Declaration of Independence, all men are equally entitled to life, liberty and the pursuit of happiness. We have engaged in an extensive war—a very bloody war—to give to other countries, not so fortunate as ourselves, their liberty. How much of our own personal liberty and of our happiness are we ready to sacrifice to protect the lives of our own people? All diseases that are communicable are preventable. The fact that they are communicable proves that they are preventable. Many of the diseases that bring patients to the hospitals are the result of communicable diseases to which the patients had been subjected, at some earlier period.

Scarlet fever and measles, and other communicable diseases, furnish one-half of the work for the ophthalmic hospitals. It is well known that typhoid fever is communicated in the food or drink; one must either eat it or drink it to get it. Bright's disease is frequently a sequel of scarlet fever. Lung trouble is equally a sequel of measles, and frequently of whooping cough.

Now, if these widespread diseases with their train of terrible consequences can, indeed, be stamped out, it would seem that the State ought to relax no vigilance and spare no expense to that end.

On the theory that every disease that is communicable is preventable, every child that is born healthy and well who dies before becoming intelligently responsible for its own acts is killed, and some one is responsible for that death.

It is time that the health and the lives of the people received as much attention as the property and the liberties of the people. We have courts and officers to protect the property and liberties of the people, but how many well-educated thoroughly trained health officers to protect public health?

If a child in our streets were assaulted by a ruffian, the police force of the town would be at once called out to hunt down the assailant. If the child were injured, or five dollars in value taken from her, the ruffian, if found would be brought to court, tried and sentenced to prison for a term of months, and probably years; but, if a child walking our streets contracts a disease, no arrests are made; probably no investigation follows. If a murder were committed, instead of an assault, a coroner would make a very patient, diligent and careful inquiry to locate the responsibility for the crime. If a child dies from a preventable disease, the health officer is not permitted to make an investigation in any degree so thorough as that of the coroner, in order to locate the responsibility of the people or of the community for the disease.

While we have adequate police force to protect life and property against violence, and sufficient laws for the restraint of those who are of evil disposition, we have only the vaguest and most unsatisfactory regulations to protect ourselves and our children in what is of far more value than any worldly possessions, and to restrain those who, though without evil intent, disseminate disease through criminal carelessness.

The need of better legislation on this matter is already widely recognized, but our legislators themselves see the need of more intelligent understanding of the subject before it can be made practicable.

There has been great research during late years into the principles of sanitation, and valuable discoveries have doubtless been made, but for what public benefit, unless the results are co-ordinated, brought to the test, and in some way made ready for efficient use by the ordinary public servant?

It is not given to every city to have a man for Mayor, who is trained at once in medical knowledge, in military experience, and in an understanding of men, as was the case with General Wood at Santiago. Where are our legislators to find a basis for their judgment in these matters? Will they gather the material for it from the pages of medical journals and Science Reviews, or from the columns of the daily press, or will they find it floating in the air? When a State has passed wise Sanitary Laws, as the State of Connecticut has recently done, where are the health officers to be found competent to administer them? How are such men to be educated?

There is no place in the world where a health officer can be educated. The best authorities that we have on public health are those who have made a study of medicine with the idea of treating disease, but there is no place where the prevention of disease is specifically taught.

It is plain that the new wine needs new bottles; that great questions of public health can no longer be relegated to the private practitioner, but must be dealt with by the magistrate, the legislator, the public functionary of every grade, and by the voter. There is need of a broad, free discussion of the principles involved in public sanitation, a wide publication of test and experiments made to this end, and concise statements of results which may have been reached. All this should be in the hands of men competent to exercise judgment and speak with authority. A mere voluntary association of men of science would not meet the need. Such associations already exist.

The following plan has ben suggested for the creation of a body which should have for its object the thorough equipment of those whose duty it may be to deal with the prevention of disease; a body which could, by diploma, or some appropriate formal recognition, declare that this one or that one has made such study of this subject as to give him expert qualification, so that he is competent to deal with this subtle, yet vitally important matter:

First. The endowment of a chair of preventive medicine in each of the leading Medical Colleges of the country, selecting those which have special advantages for laboratory practice.

Second. The establishment of an Institute, the members of which should be the incumbents of the chairs previously mentioned.

Third. The award of prizes by this Institute for essays of special merit and for discoveries in Sanitary Science.

Fourth. The establishment of Fellowships for a limited number of advanced students.

The question is immediately suggested, how the means could be found to establish these chairs, as well as to provide for the publications of the Institute, the prizes and Fellowships.

The answer is that money for chairitable purposes is always seeking for channels to flow in, as money for investment is doing. Those who are ready to endow hospitals, and to spend large amounts, of money for the relief of the sick and the care of disease, will be equally ready to bestow their possessions for the prevention of disease, if only they can be convinced of the need of such bestowal, and assured of the wise administration of their gifts.

Let it be known that in the judgment of competent men such an establishment would be wise and useful and undoubtedly men of broad charity will be found to respond to the call for its support.

REMARKS CONCERNING THE VICE OF SMOKING AMONG YOUTHS, AND SUGGESTIONS AS TO THE MEANS OF OVERCOMING IT.

By JUAN BREÑA, M. D., Zacatecas, Mexico.

"Juvenile smoking is spreading like an epidemic. It is impossible to estimate the injury which boys are thus doing themselves. Surely something should be done, and done promptly to put a stop to all this mischief."—R. Martin.

A dissertation of a general character against the use of tobacco would be at the present time not only unheeded but silenced by the disapproval which is met by everything which is in opposition to inclinations and customs of universal acceptance.

After a period in which anathemas have been hurled and the worst evils prognosticated against smokers, we have entered into another in which it has been affirmed, not only that "for the smoker, tobacco is the best barometer of health," but also that "since the habit of smoking has obtained in the Department of Lot in France, the general state of health has improved there," etc.[1]

In this question, as in many others, time has proved that the truth lies equally distant from the two opposite opinions which have been supported by science.

The medical men who, some years ago, on the strength of having found the very violent poison of nicotine in the leaves and the smoke of tobacco, attributed to it the cause of a large number of diseases, such as cerebral congestion, "ambliopia," "neuritis perifericas," dyspepsia, nervous prostration, giddiness, "paraplegia," carcinoma of the mouth, "angina pectoris," etc., etc., undoubtedly committed unwarrantable exaggerations. This fact has been shown both by the observation in many cases of the above-named complaints in persons who are not smokers, and this other noteworthy circumstance, namely, that the degree of toxical influence found in tobaccos of different kinds and from different places is not in direct relation of the amount of nicotine contained by each. Thus, for example, amongst the different kinds of tobacco consumed in France, such as the "petit Bordeaux," the "toneins," the petit caporal," etc., there are some, for example that grown in La Haute Saone, which gives in analysis 7 and 8 per cent. of the terrible alkaloid, which the red tobacco of Turkey contains it only in the proportion of one-half per cent., and that of Havana of one per cent.

[1] Dr. Demaux.

Accordingly, any novice will smoke the whole of a "petit caporal" or any other French cigarette, without feeling any nausea, whilst if he inhale two or three Turkish "chibouks," or take a few puffs of a Havana cigarette he will feel quite upset.

Wherefore, the many symptoms of poisoning produced by tobacco cannot be attributed to the deleterious principal already mentioned, but to the essential or aromatic oils inherent in the plant, or to the special susceptibilities analogous to those which, under certain circumstances, produce a tendency to headache or other nervous effects owing to the inhaling of vegetable aromas.

However, this may be and in view of the fact that the use of tobacco is general all over the globe inhabited by civilized men or by savages, alike in hot or cold climates, we must acknowledge that there is not only a habit or custom involved, but a real necessity peculiar to and distinctive of the human race. "If we wish to hear the opinion of a smoker," says the dictionary of Larouse, "he will tell us that to smoke is to obtain a truce from sadness, from painful preoccupations and from the petty cares of life, from domestic troubles and from the worries of a poorly-provided home; it is also, as regards intellectual and artistic work, a means of obtaining a widening and clear-sightedness of ideas by means of a slight excitement, which generally would otherwise escape us; it is a refuge from what is annoying or repugnant to us, from displeasure with ourselves or with others; it is, as regards manual occupation, a relief from the sensations of fatigue, of weariness, of discouragement, as also an antidote to the evils resulting from a cold, moist, unhealthy atmosphere; it is, in fine, a pleasure arising from a slight congestion of the brain, a passing stupor, a kind of intoxication of a mild nature which soothes the nerves and prevents them from becoming over-excited." To quote Figuier: "Tobacco is an excitant of the brain, it exercises on men the seductiveness and attractiveness of every pleasurable excitant; ask an intelligent smoker what are his motives for smoking, and he will answer that tobacco exercises on his spirit a pleasing influence, calms him when he is agitated and lulls him when he is calm; at other times it excites his imagination and dulls his sorrows or takes his attention from painful thoughts. It can well be conceived that when the mind is weary of what one sees so often in daily life, the desire may arise to wander through an imaginary world under the influence of a certain amount of transitory stupefaction, or that dreamy, poetical natures should have recourse to such stupefaction in order to rise in search of the ideal, the only refuge which heaven holds out to us from the bitterness of sad reality. But, to look at the other side, the hygienist will always have reasons and

unanswerable facts to make him refuse to admit in the "divine weed" the incomparable virtues which its votaries have attributed to it as an assurance of the duration and regularity of the physiological functions.

Impartial observance, in accord with the laws which determine vital phenomena, only shows that in the case of the adult man, the action of tobacco, in rational doses, is not so harmful as was affirmed some years ago, and that when this substance, the noxious effects of which may be, to a certain extent, corrected by the use of other excitants, such as tea, coffee, etc., produces morbid disturbances, this is due to the abuse of it, or to exceptional predispositions of the organism in question.

The same remark is not applicable to childhood or youth, for experience shows that at these early periods of life, the habit of smoking injures and impedes the normal development of the cerebral organs and others not less important. The disorders of the stomach so common amongst schoolboys have been observed to be more severe in the case of those who are addicted to smoking, and although any evident connection between the complaint and the habit in question has been denied, we must not forget the coincidence when we are considering the health of school boys. Amongst young people there is no taste, habit or inclination which does not tend to assume the force of a passion, wherefore they are more exposed than grown-up people to suffer, through immoderation, the noxious effects of the "direful weed."

These are principally disordered digestion, fatigue in the organs of circulation, depression in the nervous centers and, finally, a deficiency in vital energy which may be expressed as extraordinary morbid frailty.

I must also state that, of late years, the taste for tobacco has spread to an alarming extent amongst youths. "Anyone," says one of the most highly esteemed medical papers of Europe,[1] "or, rather, everyone who daily meets with that presumptuous atom of mankind, the boy cigarette-smoker, must have been astonished at the general distribution of the prodigy. Equal, if not greater, is the surprise excited by his diminutive size and exceedingly tender age. Some years ago it was the boy of twelve, fourteen or sixteen that opened our eyes. Now it is the six or eight years old, the literal infant who prolongs his still recent privilege of suction in a fashion undoubtedly hurtful by perverting at a critical period the sensitive processes of nervous action and nutritive change."

1 The Lancet, 1891, p. 793.

Dr. Stevens, President of Wyoming Scientific College,[1] published last year some statistics on the effect of tobacco on the development of young persons. The small number of these observations, though they may not authorize us to form general conclusions, at least afford interest from the point of view of the public health. In 187 members of the Yale class of 1891 it was seen that those who were not addicted to smoking increased in weight during the scholastic period 10.4 per cent. more than the habitual smoker, and 6.6 per cent. more than those who smoked cigarettes only at rare intervals. Furthermore, those of the first group exceeded in stature those of the second by 24 per cent. and those of the third group by 12 per cent. Comparative measurements of the circumference of the thorax showed an average of 26.7 and 22 per cent., respectively, in favor of the non-smoker, as also a respiratory capacity of 77.5 and 49 per cent. greater than that of the rest of the students. Similar investigation made by Dr. Edward Hitchcock in the Amherst class of 1891 led to the following results: Those who did not smoke increased in weight during the college course 24 per cent. more than those who did, the former exceeding the latter by 37 per cent. in stature, 24 per cent. in width of chest, and 75 per cent. in lung capacity:

In relation to the injuries caused by tobacco in the student class, Dr. Mendelsohn cites certain observations which confirm what has been stated above.[2] For example, in the year 1890 a circular containing several questions was addressed to each student of the medical academy of the Army and of the Technological Institute, which was answered by 1071 students. Of the medical students 54.66 per cent. were smokers, and of the students of the Technological Institute only 47.18 per cent. The greater part of them began to smoke at the age of seventeen years, two at six years of age, three at nine, eleven at ten, five at eleven and twenty-eight at twelve years of age; 16.09 per cent. suffered from the respiratory organs, whilst only 10.69 per cent. of the non-smokers did so. The sufferers from the digestive canal were in the respective proportions of 11.88 and 9.92 per cent., of which 8.77 and 3.22 per cent. had lung complications. The boys who had learned to smoke before the age of sixteen presented a higher proportion of invalids (19.05, 13.09 and 13.69 per cent. in the three groups referred to) than those who took to the habit at the age of sixteen or later (14.77, 11.34 and 6.6 per cent. respectively).

It is impossible to read these and other articles which appear from time to time without becoming convinced of the urgent need which exists for the correction of an evil of such deplorable consequences

1 The American Quarterly Journal of Inebriety.

2 The Journal of the Russian National Health Society.

for the coming generations. In Germany, and in some States of this great Republic, there exist legal enactments prohibiting boys of under sixteen years of age from smoking in public places, and punishing those who provide them with the means of doing so. Stress has already been laid on the utility, for the stamping out of the vice in question, in including, as an integral part of primary instruction, definite ideas regarding the injuries resulting from this vice, whether we look upon them from an economic point of view or from that of the preservation of the health of individuals or of the improvement of the species. If the lesson were to a certain extent objective, that is to say, supported by the example of teachers who are averse to the use of tobacco, it would create a deeper impression on the minds of the boys and would form a solid basis for their future conduct.

I certainly lay no claim to originality in the preceding remarks, but as no one of the three nations here represented is exempt from the calamity which I have chosen as my theme, and the principal object of this Association is to strive to make general the most favorable practical methods tending toward the public health, we shall fulfill a duty in requesting our respective governments to make uniform enactments regarding this interesting subject, with the following objects:

1st. To prohibit the use of tobacco in public places in youths under sixteen years of age, in any form, and to punish those who provide them with the means of using it.

2d. To give preference in Government educational establishments to teachers who are non-smokers.

3d. To add to the official programme of primary instruction lessons, pointing out the manifold evils resulting from the use of tobacco to the mental and physical constitution, more especially during the early years of life.

NECESSITY OF THE HYGIENIC ANALYSIS OF MILK WHEN USED FOR THE ARTIFICIAL FEEDING OF INFANTS, AND METHOD OF DOING SO WITH RAPIDITY AND CERTAINTY.

By Dr. MANUEL GUTIERREZ, Querètaro, Mexico.

No one can feel any doubt as to the imperious necessity of maternal nursing as a most important factor in the diminution of mortality and increase of the population of any country; but as it is not possible for all mothers to do so, either because they do not desire or because they do not understand how to do so, and not being always able to count on the services of a good wet nurse, the necessity has arisen for the use of artificial food, and for the regulation of its use, seeing that, like prostitution, it is an evil that cannot be suppressed.

I will not follow through their different stages the different methods known to all, by which attempts have been made to substitute for human milk that of different species of animals, or to modify the latter with the addition or suppression of certain elements. It has even been attempted to compose certain chemical mixtures which imitate the composition of the natural food, as if any similarity could exist between a simple combination of inert matters and a live liquid, such as milk.

Neither will I make any reference to the enormous number of deaths which have resulted from a dietary system so entirely opposed to everything that nature indicates.

If a single article of food which is administered to different individuals is tolerated by some and found injurious by others, what must we expect to happen in a practice that is entirely adventurous of feeding children with the innumerable artificial foods which supplant the diet that nature has indicated? Experience has clearly shown us what are these results. All of them may obtain a certain success but they all have their failures. How often do we see children who are models of health and are presented as an incentive to imitation, because they appear strong and robust, but who really are nothing more than examples of the debilitated organisms which are caused by the continuous use of feculent matters, or in any case, present a result which is very far from that obtained when the women do not surrender in any way their sacred rights to nurse their own children.

It is true that bacteriology has shown us the existence of pathogenic microbes in milk, but at the same time it has shown us the way to prevent and cure them, thus opening up a new avenue and establishing a new point of departure in this question.

In spite of all the methods of sterilization which are practiced by the followers of Pasteur and Soxhlet, or by the simple ebulition or heating in a "bain de marie," which requires special apparatus in the former case or special care in the second and, although the milk so prepared may be thoroughly aseptic, it will not have varied in the slightest as regards its composition and richness in lactose, caseine and butter, and if the proportion of these elements is not equal or similar to that of human milk, it will always be unadapted to the digestive apparatus of a child.

This opinion of mine is founded on practice, which also leads me to consider that the maternal milk, or that of a good wet nurse, cannot be replaced; that in the absence of one or the other it is preferable to make use of a milk that by its composition resembles those, and that only in the case of its being impossible to procure human milk, or of this having proved itself injurious, should use be made of sterilized milk.

Being unwilling to accept my exclusive opinion, I have requested that of different persons who in Mexico, either through their official position or through their specialty in the treatment of infantile diseases, are acknowledged authorities on this point.

Drs. Licéaga, Domínguez, Icaza, Tejeda Guzmán, Eduardo Vargas and Morales Pereira have kindly communicated to me the results of their observations, which can be summarized as follows:

a. "Abstention from the dietary methods which we study, because I consider that the action of heat, as employed for that purpose, alters the lacteal components." (Dr. Tejeda Guzmán.)

b. "The sterilization gives good results when the child is healthy; otherwise it must not be used." (Dr. Vargas.)

c. "Sterilized milk is sometimes successful, but it does not in any way take the place of the maternal milk." (Drs. Licéaga and Icaza.)

d. "Sterilization was unconsciously practiced long ago by the boiling of milk, and that would take away a great deal of the novelty from the modern method." (Dr. Icaza.)

e. "The difficulties of this process depend upon the use of the natural milk; but by adding water to it in a proper proportion and according to the age of the child, it gives good results and in certain cases has taken the place of the wet nurse from the date of birth." (Dr. Morales Pereira.)

f. "The attempts made in the foundling asylums during the months of October, November and December, 1898, to establish a ward for artificial nursing, by the employment of sterilized milk produced the terrible result of the death of the twelve children who were submitted to the trial, although we have no means of ascertaining that the food was entirely to blame for this unfortunate termination, or that part of it could not be attributed to some negligence in the management." (Dr. Domínguez.)

We, therefore, see that experience does not authorize artificial feeding except in a partial manner and under special circumstances.

Allowing, therefore, that the suppression of the pathogenic elements in the milk must diminish the mortality of the children who are fed with it, the triumph thus obtained is not, and cannot be the end of the work, because the principal difficulty still remains, which lies in the indigestion or difficult digestion of a food, that on account of its chemical characteristics is very far from having any similarity to the maternal food.

Consequently, whenever a mother finds herself under the hard necessity of infringing the natural laws of alimentation, she assumes the unavoidable duty of analyzing the milk which is to be employed so as to ascertain whether the modifications to which it will be subjected, are in consonance with the age, delicacy and condition of the digestive organs of the child.

In support of this opinion it is only necessary for me to remind my hearers that the cow's milk, which is generally preferred on account of its abundance and constant production, contains less butter, very much less lactose, and more than double the proportion of caseine and salts than human milk.

A complete analysis of the milk would be the most certain means of success under the supposed circumstances; but this method is very dilatory, and it is generally thought that enough has been done by measuring the density, weight of the fat and the proportion of lactose, all of which can be easily and rapidly ascertained by the employment of the lacto-densimeter of Guévenue of the lacto-butirometer of Marchand and of the Fehling liquor.

I have nothing to say with respect to the first and third methods, the details of which and their application are matters of general knowledge. As regards the second, it is well known that the instrument which is intended to show the weight of fat, gives indications that are entirely different in their utility, according as it is a question of hygienic analysis in general, or of that which ought to govern the feeding of children. In the former case we do not require anything more than the figures obtained with the lacto-butirometer of

Marchand, which although they cannot show the proportions of butter inferior to 12.60 degrees (the proportion that is dissolved in the mixture of alcohol and ether) do not, for this reason, present any difficulty, as this class of milk is considered very inferior; but they are insufficient in the latter case, in which it is necessary to know with great exactness the richness of the milk, so as to able to arrange the mixtures of different compositions according to the circumstances.

For this reason, my esteemed friend, Dr. Gaviño, Professor of Hygiene in the School of Medicine in Mexico, prefers to use the butirometer of Gerber, which besides being very correct, has the advantage of indicating at the same time the density and temperature, and of allowing several analyses to be taken simultaneously.

A centrifuge with conical top and bottom and with eight metallic clasps carrying four brass tubes crossed through its center by a shaft that drives it; a thermo-densimeter with a scale for the necessary corrections; a graduated pipette to measure the milk and another for the reception of the re-agent; a special graduated probeta which is the butirometer, and a square box for cooking by steam, are the principal parts of the Gerber instrument.

The re-agent which is necessary, is composed of a mixture of 100 cubic centimetres of sulphuric acid at 65 degrees, and 5 cubic centimetres of acetic acid which can crystallize (Gerber solution) and pure amylic alcohol.

The process consists in placing 11 cubic centimetres of milk in the probeta by means of the special pipette and then wrapping it up in a towel to protect it from the heat which is developed by the contact with 10 cubic centimetres of the Gerber solution which is afterwards added, and immediately after one cubic centimetre of amylic alcohol, after which, the butirometer is covered with a rubber stopper and the mixture agitated. If the caseine coagulates, as happens when the milk contains butter, it is necessary to wait for the dissolution of the particles until none remain, however small; the probeta is then opened to allow of the escape of gases, and again closed and taken to the rectangular box which is full of water at 80 degrees.

After an immersion of five minutes, the instrument is taken out, opened and again closed, and then placed mouth downwards in one of the brass tubes above referred to. Having filled these with a sufficient quantity of water, the apparatus is driven for the space of five minutes, after which the probeta is taken out, submerged in hot water and the proportion of fat is read off on the scale, the fat presenting itself with a beautiful amber color and separated from the

dark coffee color of the rest of the liquid, having one gramme more than that indicated in the Marchand butirometer.

The four brass tubes carried by the Gerber apparatus allow of four examinations being simultaneously made. Knowing at the same time the temperature and density, we have only to calculate the proportion of lactose in order to know all that is wanting on the subject treated of.

I do not wish to bring this paper to an end without indicating a complement of the analysis, which is of special importance in the foundling hospitals, and the details of which I owe to the kindness of Professor Gaviño, already mentioned. This refers to the investigation of the proportion of lactic acid which might produce coagulation in the milk, either before or immediately after its reaching the stomach.

A solution of soda, that for each cubic centimetre will neutralize a miligramme of lactic acid, is slowly poured into 10 cubic centimetres of milk, to which a drop of phenolphthalein has been added, and a red or purple color at once appears through the absence of acidity in the liquid, after which the scale is read to discover the quantity of re-agent used, and therefore that of the acid in the milk.

I beg that my hearers will pardon the uninteresting character and the excess of detail in this imperfect work which I have the honor to present to this learned assembly.

REPORT OF SECTION COMMITTEE ON BACTERIOLOGY OF MILK IN ITS SANITARY RELATIONS.

(Read in Section of Bacteriology and Chemistry.)

Your Committee on Bacteriology of Milk in Its Sanitary Relations begs leave to submit the following report.

In making this report it was not our expectation to be able to add materially by the way of research work to the stock of knowledge regarding this subject, but to bring together in compact form a summary of the more important findings of especially the last year as related to disease contracted or disseminated through the medium of milk.

While this report does not pretend to be fully complete, it has been our endeavor to present the subjects treated in a manner that would represent the current opinions at the present time. On some questions it is yet necessary to suspend definite judgment as the data at hand is so conflicting and contradictory as to render decided opinions unwise.

The importance of milk as a medium of infection has, of course, been more or less thoroughly realized for years, but the fact that infection continues to be traced to such sources shows that the public at least do not apprehend the danger sufficiently enough to effectively guard against contagion and disease from such sources. This danger is rendered greater in this country than in many European countries by the fact that here milk is almost always consumed in a raw condition, in which state it becomes readily possible for it to serve as a vehicle for the transmission of disease germs, if such organisms are able to grow in the same, in competition with the distinctively normal dairy bacteria. That such growth is possible has been often shown experimentally and also clinically by the fact that epidemics of contagious disease have been undoubtedly traced to such sources.

As milk is secreted in the udder of the healthy cow, it contains no bacteria, but even before it is drawn from this organ, contamination occurs through the ingress of organisms by the way of the milk ducts and in diseased animals from the circulation itself. Fortunately there are very few diseases toward which both the human and bovine races are susceptible; the most important of these is that of tuberculosis.

Tuberculosis. Concerning the possibility of contracting this disease through the ingestion of milk there has been, and still is, considerable difference of opinion. This danger has, in recent years, frequently been regarded as a very serious menace to public health.

At the present time there is a growing belief that while th danger certainly exists, its extent has been considerably overrated. The chief facts from which our conclusions must be drawn are the following:

1. Human tuberculosis and bovine tuberculosis are the same disease. This is generally admitted.

2. The milk from tuberculous cattle may under certain circumstances be infected with the tubercle bacillus. The conditions under which this may take place are not yet, however, fully settled. It does not occur in all cases of bovine tuberculosis, nor even in a majority of cases. In two states of the disease it doubtless is common. (1) When the disease has attacked the udder. (2) In the cases of generalized tuberculosis. The great majority of cases of bovine tuberculosis are neither localized in the udder, nor are they generalized. In these cases it is doubtful whether the milk is liable to infection.

The question is still unsettled whether there is much probability that cows which show no physical signs of the disease, but react to the tuberculin test, will give milk contaminated with tubercle organisms. That they may do so at times appears certain from the careful investigations that have already been made, but the extent to which market milk is contaminated with tubercle bacilli is not by any means definitely determined.

In spite of the fact that the tubercle bacillus is so well known, no practical method has yet been devised which can be used by inspectors to determine its presence in milk. Methods of microscopic examination are occasionally employed that will frequently show its presence in the liquid. But they are so uncertain that negative results cannot be relied upon as indicating their absence, and even a positive result is unreliable, since other species of harmless bacteria may respond to the same microscopic test. The only reliable test is by inoculating the milk into guinea pigs, and this test, while exquisitely delicate, requires some weeks for completion. As a practical method of testing milk it is therefore too slow to be of much use, and it can hardly be adopted by health boards as a means of testing the public milk supply.

Although it may be assumed that tubercle bacilli are at times to be found in market milk, yet we do not know with exactitude the extent of the danger from such to human beings. We have no experimental evidence that enables us to compute the relative susceptibility to intestinal infection of the young and the adult, but the greater frequency of tabes mesenterica in young children would indicate from a clinical point of view, the increased susceptibility of the younger

class. While this fact is quite generally admitted as an important factor in tuberculosis of young children, the case is by no means so strong with reference to the development of the disease in the adult.

The following data should be kept in mind in judging of the importance of this phase of the question:

(1) The disease in the adult is pre-eminently a pulmonary disease, and often where infection of peritoneal cavity occurs, the primary focus of the disease may not be associated with the intestinal canal.

(2) While bovine tuberculosis has until very recent years been increasing rapidly, human tuberculosis has on the other hand been more or less steadily declining.

(3) It is now quite generally admitted that at least in virulence there is considerable difference between the human and bovine type of this disease. The bovine has been shown to be more pathogenic for cattle and most mammals, but whether this would apply to the human or not, has not, for obvious reasons, been experimentally determined. From the cases recently reported by Ravenel[1], it is evident though that inoculation tuberculosis may be contracted in the human from organisms of undoubted bovine origin.

While the question, at least so far as the adult is concerned, cannot be regarded as satisfactorily answered at the present time, it is the belief of your committee that the extent of the danger to adults has been very generally overestimated. That such a danger exists in the case of children probably would not be disputed, but there is yet needed considerable stronger proof than has already been adduced to place this phase of the question on a satisfactory basis.

Finally it must be noted that whatever danger exists may be wholly removed by the proper pasteurization of the milk. If milk is heated in a closed receptacle under conditions that prevent the formation of a surface pellicle (so-called "scalded skin"), to a temperature of 60° C. 140° F.) for 15-20 minutes, this period is amply sufficient to destroy the vitality of the tubercle bacillus. Even so susceptible an animal as the guinea pig will withstand the inoculation of large doses of milk so treated. Milk or cream handled in this way is not changed in taste or appearance; in fact cream rises as readily on it as on raw milk. Where the heating takes place in an open vat or vessel under conditions permitting of the formation of the scalded layer, the vitality of the organism is retained for much longer periods of time. As these conditions are much more likely to prevail where milk is treated in a small way, as in the family, than where pasteurized on a commercial scale, in tightly closed rotating machines, as are mainly used here in this country, this caution should be especially empha-

[1] Phil. Med. Journal, 1900, Sept.

sized in public health work. All that is needed is sufficiently tight closure to prevent the formation of the coagulated material either on the surface or in the milk. In this material, the organism seems to be protected from the influence of the heat.

Of the class of maladies directly transmissible from animal to man, this disease is practically the only representative. Foot and mouth disease of cattle and aphthous fever in children are in all probability produced by the same organism, and contraction of the disease happens through the ingestion of milk of diseased animals. As this disease does not occur in this country, although extensive in Europe, further mention of it under American conditions need not be made.

Typhoid Fever, Diphtheria, Etc.

But disease is not infrequently contracted from milk by infection of the same subsequent to its withdrawal from the cow. This happens so frequently with typhoid fever, diphtheria, and scarlet fever that this mode of origin is always taken into consideration in locating the cause of any outbreak. Your committee has tried to collect the more important outbreaks that have occurred during the past year, in which the causal connection with the milk supply has been more or less perfectly established, but the fact that the data relating to disease outbreaks during this period has not yet been published except in fragmentary form renders such a list very incomplete. In the cases collected the usual methods of infection function, such as persons convalescing from the disease being concerned in the handling of the milk, infection from polluted water used in washing utensils, etc. One instance is of more than usual interest, and in our judgment merits mention.

In the Leeds (England) General Hospital,[1] a considerable number of the nurses in the typhoid wards developed typhoid. On investigation it was found that the nurses were in the habit of taking milk in glasses to the ward, where they were allowed to stand until they were consumed by them during the night. This practice was stopped, the nurses being required to wash their hands and go to the pantry or kitchen, in which room they drank the milk. No further cases occurred in the staff after this order went into effect. This would indicate infection of the milk through the medium of the air direct.

While the collection of epidemiological data relating to disease outbreaks incited by milk infected in various ways is of value, still it is more important for us to know at the present time the way these organisms comport themselves in normal milk under normal conditions. During the past year one of the members of your committee, Dr. Connell, has been engaged in studies on the relation of typhoid,

[1] Oliver, Brit. Med. Journal, 1899, p. 1041.

diphtheria and cholera in milk under different conditions. His results while traversing old ground in part, may be of interest in this connection.

In fresh milk he found B. typhosus able to increase rapidly in numbers for the first twenty-four hours, and it could be demonstrated in samples up to the fifth or sixth day. In connection with the lactic acid forms, it appears to be able to thrive at ordinary temperatures and for a period that measures in a general way the commercial life of the milk.

With the diphtheria germ the conditions of growth in milk are by no means so favorable. Very slow multiplication was noted in some cases during the first sixteen hours, then a cessation and finally death in three to five days. While it is unable to compete with the typhoid organism, still it retains its vitality sufficiently long to produce infection if such contaminated milk was consumed.

In connection with the presence of diphtheria bacilli in milk, the results of Eyre, published this year, are of importance. He finds[1] in normal milk not infrequently bacilli that resemble B. diphtheriæ, especially in morphological appearance. These organisms exhibit segmentation, metachromatism and clubbed involution forms, but they can be differentiated from the genuine Klebs-Lœffler organism by cultural and animal tests.

The relation of milk to the non-specific troubles that are particularly incident to childhood is a question of even greater importance than a consideration of the more specific diseases, but your committee has been obliged to omit this important phase of the question. At the present time the relation of bacteria derived from milk supplies to infantile disorders is not at all well understood. There is great need of further work along these lines. The work inaugurated by Flügge, Booker and others must be much extended before it will be possible to gain an adequate conception of the rôle that microörganisms play in this class of troubles.

From a hygienic point of view, it is evident that the bacteria that are liable to be found in milk are of considerable importance in accounting for the dissemination of disease. For the most part deleterious organisms are not derived from the cow directly, but find their way into milk through careless methods of handling. A recognition of this fact is the foundation of much of the improvement that is now going on in the question of city milk supplies. For many years the only safeguard that was thrown about the character of the supplies offered for sale was the amount of butter fat they contained. The sanitary quality was completely ignored, but thanks to the move-

[1] Brit. Med. Journal, 1900, p. 426.

ment that is now so rapidly spreading over the country, much more interest is being manifested in the question of the character of food stuffs, and of these milk is perhaps the most important, because it is used by so large a class, and itself is a food substance that is especially likely to become unwholesome through abnormal changes induced by dirty and careless methods of handling.

H. L. Russell, Chairman.
H. W. Conn.
W. T. Connell.
R. G. Freeman.

REPORT OF COMMITTEE ON DISINFECTANTS.

By FRANKLIN C. ROBINSON, Chairman.

PRELIMINARY STATEMENT.

The report is made up of:

1. A review of experimental work done and published during 1898-1899 and as much of 1900 as had passed at the time of its make-up.

2. Preliminary reports of certain sub-committees to which were assigned certain topics which were felt to be fundamental in carrying on the work of disinfection experiments and making clear what has already been done.

These sub-committees and topics were as follows:

1. Standard Cultures and Methods—Drs. E. H. Wilson, H. W. Hill, Wyatt Johnston.

2. Standard Methods of Determining and Expressing Chemical Strength of Disinfectants—L. P. Kinnicutt, F. C. Robinson, E. G. Horton.

3. Nomenclature of Disinfectants and Processes—Adolph Gehrmann, H. D. Pease, H. W. Hill.

4. Relations of Toxins and Ptomaines to Disinfection—E. A. de Schweinitz, A. H. Doty, M. P. Ravenel.

5. Reduction of Virulence by Disinfectants—H. Biggs, A. Ravold, A. Schuyzer, E. Licéaga.

In some cases the work of the sub-committees was not ready for even preliminary report, but it is hoped that investigations will be carried on and reports from all received at the next meeting.

Dr. H. W. Hill voluntarily served as secretary of the committee, and to him is largely due the success of the work.

REVIEW OF WORK DONE IN 1898-1899-1900 ON DISINFECTION.

(Report made October 1, 1900.)

By F. C. ROBINSON.

Room Disinfection, German Journals.

The first important modification of the apparatus designed to use formaldehyde in room disinfection, following the different autoclaves, was the so-called Walter-Schlossman apparatus by which a mixture of formalin and glycerin was thrown into the air of the room by a suitable atomizer. Several articles have appeared in the German periodicals descriptive of tests made of the efficiency, etc., of this. Several of these were in 1897. The first to be noticed in 1898 is that

of A. Pfuhl entitled, "The bacteria killing power of the new Leingner apparatus for disinfection." Leingner had improved the apparatus for using formalin and glycerin. This was published in Hygien. Rundsch, for 1898, No. 23, and is reviewed in the Centralblatt für Bacteriologie for May, 1899.

He claimed that all bacteria, including anthrax with spores, were killed in five hours upon all freely exposed surfaces, but not when concealed in drawers or in open reagent glasses. He regards it as the most satisfactory form of room disinfection, its chief disadvantage being that the spray is very irritating to the throat and lungs of the operators.

Schönfield used the same apparatus, and published his results in the "Deutsch. Med. Wochensch.", 1898, No. 40. He also found it very effective, even killing cultures of pyogenes aureus when they were exposed in the pockets of clothing and in the toe of a shoe. But he objects to the use of this material owing to its injurious action upon individuals and animals, and to the persistence of its odor even after the use of ammonia. He thinks the cost excessive also. He further experimented with formalin solutions and claimed that a 2 per cent. solution was sufficient to thoroughly disinfect clothing, and even mattresses which had been treated with it.

Czaplewski has an article in No. 41, 1898, of "Münch. Med. Wochenschr.", in which he compares the amounts of formaldehyde per cubic meter liberated in the experiments with different machines according to the directions sent with them. He says that these are, according to Roux and Trillat, 3.02 grams, to Rosenberg 1.75, to Schering 2.3, to Leingner-Schlossman 7.5. He notes also that with the latter much more water vapor is given off, 43.75 c.c. to 1 cubic meter. He claims that the greater effectiveness of the glycoformal is due entirely to the increased amount of formaldehyde and water. With Schering's apparatus and dry pastilles he got only negative results with all the common bacteria when exposed in blood serum, because, as he believed, of an action of the albumen on the formaldehyde.

He finally got his best results from spraying into the room a mixture of 1000 c.c. of formalin with 1600 c.c. water. He used the Lister spraying apparatus. He found this much superior to the glycerin mixture, to which he made the same objection that others had, namely, its lasting odor and expense. He believes also that the glycerin hinders rather than helps in the disinfection, but that moisture is always a help. He got no penetration when glycoformal was used, and rather imperfect surface action. He recommends 6.4

grams formaldehyde for every cubic meter of space, and 44 c.c. of water.

In the "Zeitschrift für Hygiene und Infectioskrankheiten," Vol. 29, 1898, C. Flugge, director of the hygienic institute in Breslau, gives a most practical and helpful article describing how he came to adopt formaldehyde for room disinfection. Not the least valuable part of his article is his description of how it is carried out by the public disinfectors in Breslau.

He found that the methods in public use in Breslau were very unpopular, and that their unpopularity led to many evasions of the law. Things were so likely to be injured that they would be removed surreptitiously before the disinfectors came, thus rendering the disinfection of little value.

He made a test of the thoroughness of the methods of disinfection by asking to have one of his own rooms disinfected, in which he exposed cultures of bacteria in different places on exposed surfaces. The regular municipal disinfectors came and treated it in their most thorough manner, using sublimate solutions for all woodwork and rubbing walls and ceiling with bread. And yet after they were gone he had no difficulty in finding many of his cultures untouched.

He then began investigating formaldehyde; tried the different methods of using it and settled down upon the method of boiling a dilute solution and letting the vapor mixed with water escape into the room. The apparatus finally used is described in the article by Von Brunn given later.

He does not think it adapted to all forms of disinfection. For example, where, as in typhoid fever, bed clothing is mainly infected, and excreta must be treated he recommends the use of steam and sublimate, but in cases of diphtheria, scarlet fever, measles, tuberculosis, and influenza, which make up by far the greater number of cases where room disinfection needs to be used, he thinks the safest possible thing is to employ formaldehyde. But owing to its lack of penetrating power, all articles in the room must be exposed as perfectly as possible by spreading them out and hanging them up. The use of disinfecting solutions must not be given up, but all places where the gas cannot go easily must be washed with these.

He gives a number of test experiments showing how completely he was able to destroy bacteria with formaldehyde where the air of the room was nearly saturated with water vapor. His method has been adopted by the city of Breslau and gives perfect satisfaction.

Flugge makes one very pertinent observation. He says that disinfection of a room is at first relative. It is impossible by any practical means to kill all germs, but we should use that method which

will kill the largest percentage, and that, he thinks, is by using formaldehyde together with other things and processes.

W. Prawsnitz, in Münch. Med. Wochenschrift, 1899, No. 1, describes an apparatus for spraying formaldehyde by steam into a room. His results are not essentially different from those of Czaplewski already referred to, as well as of others who have used relatively large amounts of water.

He concludes by saying that it cannot now be doubted that when from 7 to 8 cubic centimeters of a 40 per cent. solution of formaldehyde and 40 c.c. of water are sprayed into a space of one cubic meter, all micro-organisms, even the most resisting, are killed. Of course he excepts spores from this statement. He used for test objects 24 hours' old bouillon cultures of staphylococcus aureus, pyocyaneus, and coli communis, and exposed them on pieces of thick woolen cloth.

Dr. Von Brunn, of the Hygienic Institute in Breslau has made a series of experiments upon disinfection of rooms by formaldehyde, which are published, with his conclusions, in Vol. 30, 1899, of "Zeitschrift für Hygiene und Infectionskrankheiten."

He found that the more dilute the formaldehyde solution was, the less it polymerized upon evaporation, and consequently the more effective it was in disinfection.

He found that a strength between 7 and 8 per cent. was the most efficient. When a solution of formaldehyde of this strength is evaporated rapidly or slowly, its strength changes very little. The residue in the evaporator taken at any stage of the evaporation has very nearly the strength started with. With all other strengths there is much variation, solutions stronger than this grow stronger upon evaporation, and soon begin to polymerize, while weaker solutions grow still weaker. This fact is well shown by the following table taken from his article. The first column gives strength of solutions evaporated, and the second the strength of the residues after evaporation had continued for some time. In general the residues had about one-sixth the volume of the original solution.

Percentages	
Original Solution	Residues
31.7	48.
21.5	40.43
16.5	27.15
16.35	26.7
10.73	15.
9.08	10.13
7.43	9.15
7.2	6.98
4.35	2.63

The above figures were obtained by free evaporation at common pressure. But when the evaporation was conducted in a vessel with an outlet of such size that a pressure of 29 centimeters was produced, a solution containing as much as 15 per cent. gave a residue of only 12 per cent.

He finally decided that when to one part of a 40 per cent. formaldehyde solution four parts of water were added, the best and most active solution was prepared. This makes about an 8 per cent. solution.

He, in conjunction with Flugge, devised an apparatus for evaporating this which is known as the "Breslau Apparatus," and consists of a copper receptacle heated by a spirit lamp. It does not differ in principle from the so-called "Nevy Apparatus." In use an amount of alcohol is put into the lamp so that when all burnt up a small residue of unevaporated solution will remain, thus preventing injury to the boiler.

His experiments showed that when 750 c.c. of the 40 per cent. solution of formaldehyde diluted as above were evaporated to every 100 cubic meters of room space, and the room kept closed for seven hours, cultures of diphtheria were invariably killed even when placed in position where they were not easily reached such as under table, in drawers partly opened, etc. Staphylococcus pyogenes aureus, pyocyaneus, and anthrax even with spores, were always killed when

in places freely exposed, but not always when in difficult places. He found that equally good results were obtained when the strength of the solution was doubled, and the exposure was only one-half as long.

He concludes that the disinfecting action of formaldehyde is dependent upon the presence of moisture, which absorbs the gas and condenses with it upon the surfaces of the articles present.

Upon the whole this article of Von Brunn's is the most important of any which has appeared since the first ones calling attention to this disinfectant, and should be consulted by all experimenters upon disinfection with formaldehyde.

Rubner and Perenboom write of the theory and practice of formaldehyde disinfection in Hygien. Rundschau, 1899, pages 265-272 (reviewed in Centralblatt for August, 1899). They emphasize the physical conditions of moisture and temperature. A room should be of uniform temperature, and the air moist, but not too much so. They show that while the dry gas has no disinfecting action, still if too much moisture is present the action is lessened. This is because an unsaturated article will absorb the gas and carry it into its inner parts more readily. On this account they claim that vaporizing formaldehyde and water by heat is better than spraying, for in the latter case drops of moisture are projected on to the articles and prevent sufficient absorption of the formaldehyde.

Room Disinfection, French Journals.

In the French journals little experimental work on formaldehyde has been published during 1898-1899. In the "Revue D'Hygiéne" for May, 1899, are extended comments on the papers of Flugge and Von Brunn, and a very full account of the report of a committee appointed by the Council of Hygiene of Belgium to investigate and report on the advisability of adopting formaldehyde disinfection for use in quarantine work instead of methods then in use.

M. Van Ermengem made the report for the committee. In it he reviewed carefully the work done upon formaldehyde, and finally decided that he could not yet recommend it for use in the disinfection of ships. He based his decision chiefly on its admittted lack of penetration. Ships are very likely to be contaminated with masses of excreta from patients sick with cholera, yellow fever, etc., and these must be thoroughly disinfected. He is certain that washing in sublimate solution is the best for the purpose. He quotes, with approval, Flugge's restriction of its use in room disinfection.

Dr. A. J. Martin, in the July number of the Revue D'Hygiéne, goes critically over the whole matter again, and concludes that he is forced to the opinion that as yet formaldehyde disinfection cannot

be recommended for public use in place of the older methods. He bases his conclusion upon the conflicting results of experiments and the general agreement that it does not penetrate with disinfecting power unless the quantity used and time given are more than are practical. He admits that for special purposes and cases, such as the disinfection of articles which would be injured by other disinfectants, it should be used.

Room Disinfection, American Journals.

In the Boston Med. and Surg. Journal, Nos. 24 and 25, 1899, is an account of experiments made in the city hospital at Charlottenburg, Berlin, with formaldehyde, by Dr. A. W. Fairbanks. He used as tests diphtheria, typhoid, staphylococci albi and streptococci from pus and anthrax spores. He used them on woolen and cotten cloths, and in dried masses. He left some open to the gas and enclosed others between pieces of linen and woolen cloth and between mattresses. He used from 1.5 to 2 grams formaldehyde to each cubic meter of space and generated this from the tablets used with a Schering's apparatus, and let the room be closed 24 hours. His results were as follows: All freely exposed cultures were killed, even anthrax spores. Cultures wrapped in linen were killed, but not those wrapped in woolen; those between mattresses were unaffected. Dried diphtheria membrane was not sterilized, neither were tubercle bacilli exposed in an open test tube on agar. In later experiments he found that an exposure to the gas for 12 hours was sufficient to get equally good results.

Experiments were carried on by Dr. A. Ravold of the St. Louis Board of Health, in which he used formaldehyde obtained by vaporizing formalin in a common iron pail by means of a simple alcohol lamp. The article describing his results did not come into the possession of the reviewer in time to be abstracted for this report, but his results were exceedingly favorable on tuberculous and other infectious matter. Dr. Ravold's experiments, showing the favorable action of plenty of water with formaldehyde, seem to have antedated these of Flugge and Von Brunn.

The Rhode Island State Board of Health report for 1900 contains detailed account of Dr. Ravold's work.

Doubtless other interesting articles have not come to the attention of the reviewer. He asks for any not mentioned.

In "Merck's Archives" for January and March, 1899, are two articles by Dr. F. E. Stewart of New Jersey, descriptive of formaldehyde and its uses as a disinfectant and in medicine. No new disinfection experiments with it are described.

In the Philadelphia Medical Journal, No. 12, 1898, is an article by Drs. W. H. Park and A. R. Guerard on formaldehyde in disinfection. They give the ordinary methods of using it and conclude as follows:

Formaldehyde is the best disinfectant known to use in infected dwellings. It will not penetrate as far as steam or dry heat, but for things injured by these agents, such as fine wearing apparel, furs, leather, upholstery, books and the like, formaldehyde is the only safe disinfectant.

Testing Formaldehyde.

Schumburg writes upon the method of testing formalin disinfection in the Deutsch. Med. Wochenschr., 1898, No. 52. He claims that even when the formalin in the exposed material is neutralized by ammonia, enough very frequently remains unacted upon to hinder the development of the bacteria. Especially is this the case when solid media are used to make the tests. He found that when pieces of paper or silk threads were exposed to the gas for three hours and then soaked for 24 hours in concentrated ammonia solution, they still contained traces of formaldehyde sufficient to prevent growth of unkilled germs. When liquid culture media are used this formaldehyde may be so diluted as to be inactive. He found that 7.5 formaldehyde in 100,000 of culture agar prevented growths of anthrax spores, and 2.5 to 100,000 in culture gelatin did the same. After neutralizing with ammonia, the test objects should be put into very fluid media and moved about so as to dilute the formaldehyde carried over, to an extent that it will not act.

Disinfection of Clothes in Sick Rooms.

Förster, in "Hygiene Rundschau," No. 11, 1900, gives his results in investigating the matter of disinfection of clothes, etc., which have been used in sick rooms. He wished to find some harmless and cheap solution in which these could be placed so that they could be washed afterwards in the ordinary way without danger. He found that, while sublimate 1-5000 and 3 per cent. carbolic acid destroyed all dangerous bacteria in cloth infected with chicken cholera, diphtheria, typhus fever, and pus staphylococcus, when contact was continued for six hours, at common temperatures, yet as good results were given by 10 per cent. kresol soap solution, 20 per cent. sodium carbonate solution and 1 per cent. sodium hydrate solution. Ten per cent. soft soap solution was almost entirely inactive upon the same bacteria. He recommends the use of kresol-soap solution as cheapest. For blood-stained cloth he recommends the same treatment but a rinsing in warm water before final washing.

Disinfection of Excreta.

In British Medical Journal for April 16, 1898, under this title, Drs. Charles A. Hill and John Hill Abram give the results of their experiments with the following substances:

Bichlorid of mercury	1-1000 water solution.
Formol	1-20 water solution.
Carbolic acid	1-20 water solution.
Iodid of mercury	1-4000 water solution.
Chloras	Full strength.
Chinosol	1-600 water solution.
Izal	1-200 water solution.
Creolin	1-10 water solution.
Carbolic acid (crude)	Full strength.
Chlorid of zinc	1-10 water solution.
Copper sulphate	1-20 water solution.
Boiling water.	
Sodium chlorid	1-10 water solution.
Chlorid of lime	1-10 water solution.

Their method was to mix the disinfectant thoroughly with the excreta and let the mixture stand for one-half hour. They do not give weights of excreta and disinfectant used, but evidently enough was used to make a thorough mixture. They found that they got the most complete sterilization with carbolic acid, formol, creolin, chinosol and bichlorid of mercury. Neither of the others could be relied upon. They especially recommend chinosol on account of cheapness and portability.

Alcohol as a Disinfectant.

Dr. Rafael Minervmi, of Genoa, publishes in the "Zeitschrift für Hygiene und Infectionskrankheiten," 1898, Vol. 29, his experiments upon the effects of alcohol of various dilution upon many forms of bacteria. He used alcohol of 25, 50, 70, 80, 99 per cent. He used it at common temperature and pressure, and at higher temperatures and increased pressure. He used it free and containing other disinfectants dissolved in it. His results were summarized as follows:

"Ethyl alcohol has in general a slight action as a bactericide. At normal temperatures the non-spore forming varieties are killed by it after action of from one to twenty-four hours, provided that the strength be from 50-80 per cent. alcohol with water. Solutions containing more or less alcohol than these were distinctly less germicidal. Absolute alcohol is the least in germicidal power, having very little action upon any bacteria." He found that when heated to 100° C. with pressure of 2.5-3 atmospheres, 25 and 50 per cent. alcohol was more germicidal than other strengths. He found it difficult to de-

stroy any bacteria by heating them with absolute alcohol for thirty minutes at 3.5 atmospheres of pressure.

He found that when carbolic acid, chromic acid, silver nitrate, or bichlorid of mercury were dissolved in alcohol their germicidal power was distinctly less than when dissolved in water alone, and proportionately less the more alcohol was present.

He used as test cultures, tetragenus, pyocyaneus, prodigiosus, pyogenes aureus, coli communis, subtilis spore containing, anthrax spore containing.

He exposed these on silk threads and on glass threads and metallic needles. He found their powers of resistance to be directly in the order given, the first, tetragenus, having the lead.

Dr. W. Von Brunn writes in the "Centralblatt für Bacteriologie," for September, 1900, on alcohol vapor as a disinfectant. He concludes from his experiments that alcohol has a certain disinfecting value best shown when in a 50 to 75 per cent. strength.

Dr. Taav. Laitinen has a long and important article in No. 34, 1900, of "Zeits. für Hyg. und Infections," on the action of alcohol upon the "susceptibility of animals to infectious diseases," but it is not judged to be close enough connected with disinfection to be reviewed in this paper.

Asterol.

The new disinfectant "asterol," or mercury sulphocarbolate, is the subject of an article in No. 11 of Berlin. Klin. Wochenschrift for 1899, by Steinmann. It is put upon the market in the form of a brown powder easily soluble in water.

He says it has the following good qualities:

It does not precipitate albumen.

It has strong germicidal action.

It does not injure instruments, nor the hands, and is much safer to use in wounds and surgical operations than corrosive sublimate.

Didymium Chlorid.

In the "Deutsche Thierärztliche Wochenschrift" for March, 1899, is an article by Dr. Pflücke reviewing the matter of didymium chlorid as a disinfectant.

His conclusions from a number of experiments in which he used a 50 per cent. solution as a basis, and diluted this, were as follows: "Didymium chlorid can be spoken of as a weak disinfectant only. Spore forms were not destroyed after being treated for three days with a solution containing five parts of a 50 per cent. solution of didymium chlorid in one hundred of water, but that strength was sufficient to destroy the bacteria of chicken cholera and bacilli of hog cholera in ten minutes. The solution has the advantage of being

odorless and non-poisonous, but these properties are present in other disinfectants which are much more effective than this. There seems to be no reason for recommending it for general use."

Sterilization of Catheters.

Dr. L. Wolff, in Deutschen Medicinischen Wochenschrift for March 2, 1899, gives a series of experiments in order to determine the best agent and method to sterilize catheters and similar surgical instruments. He states that the ideal disinfectant for a catheter is one which will sterilize, preserve and render it slippery at the same time. He finally settled upon a solution of equal weights of glycerin and water, containing .1 per cent. of bichloride of mercury. He recommends that this be kept in glass tubes of sufficient length to contain the catheters, and that these be kept in it when not in use. This is not a very strong disinfectant, and the instruments should remain in it for at least six hours before use to insure complete sterilization. It should be remembered also that resisting spores are not destroyed by it in that time, unless the solution is heated. But such forms are not likely to be found in urine. His experiments showed spore destruction after twenty-four hours action of the solution at common temperatures.

Sozoiodol.

A. Fasano, in Ærztl. Monatsschrift for 1898, No. 3 (reviewed in Centralblatt für Bacteriologie, May 13, 1899), gives an account of his experiments upon the action of salts of sozoiodol upon certain bacteria. He found that when agar plates infected with pus cocci were treated with .5 per cent. of zinc sozoiodol no development took place. The same result was obtained with the streptococcus from erysipelas, and with the diphtheria bacillus. He used mercury sozoiodol upon the same germs with the same result. He used the zinc salt in the powder form and the mercury salt in a 1-10 solution. He found the sodium sozoiodol decidedly less active as a disinfectant.

To compare more accurately the action of these three salts, he added 1-1000 zinc sozoiodol and 1-1000 mercury sozoiodol to bouillon cultures of diphtheria, and 1-100 sodium sozoiodol to similar cultures and incubated them. He found that the bacilli were killed by the mercury and zinc salts in 45 minutes, and by the sodium salt only after one hour.

He found that gonococcus in blood serum was killed by 1-100 zinc sozoiodol in 30 minutes. He found that anthrax in agar plates was killed by 3-1000 zinc sozoiodol in from 30-40 minutes.

The Kresols.

Dr. Carl Seybold described in "Zeit. für Hygien. und Infections," Vol. 29, 1898, his experiments undertaken to show the relative disin-

fecting power of orthokresol, parakresol, trikresol (Schering), metakresol (Hauff), phenol and guaiacol.

He used these compounds in form of 2 per cent. water solution adding them to tubes of meat broth and culture agar so that 1 per cent. was actually present.

For test objects he used prodigiosus, pyocyaneus pyogenes aureus, and anthrax.

His general conclusions are as follows:

1. None of them acts to destroy anthrax spores.

2. The kresols are considerably superior to phenol and guaiacol in power of destroying the other test objects named.

3. Metakresol (Hauff) is superior to the others; parakresol is next to it.

4. Metakresol is the least poisonous, parakresol the most, of the kresols.

5. The addition of 18 per cent. of sodium chlorid to the metakresol solution increased somewhat its disinfecting power, but not enough to make it a thing to be recommended.

6. Compared with phenol, metakresol is stronger in disinfection power, not so poisonous, has less smell, and does not injure hands nor instruments.

Disinfection of Tuberculous Sputa.

Dr. Donato Ottolenghi, in "Zeit. für Hygiene und Infections," Vol. 34, 1900, discusses the important matter of disinfection of tuberculous sputa in rooms. He notes the earlier statements of the successful use of sulphurous acid for this purpose by Thoinot, and the disagreeing results of Bordoni, Miguel, Abba, Bondelli, and Gärtner. He then considers formaldehyde, noting first the reports of its successful use by Pfuhl, who killed tuberculosis in twelve hours, in a room of 364 cubic meters, using the Trillat autoclave; of Valagussa, who destroyed the germs in a 70 cubic meter room by use of the autoclave and 36 hours' standing; of Aronson and Mœller, Vaillard and Lemoine, and finally of Neisser, all of whom killed the bacillus in different room experiments with formaldehyde. He notes also that these and other experimenters failed to kill these as well as other bacteria in some places in the rooms experimented upon, and that the recent Italian Congress of Hygiene decided not to recommend it for public use owing to this uncertainty of action.

Chlorid of lime is next considered. Jäger, in 1889, found that a mixture of one part of this with two of water failed to kill tubercle bacilli when threads containing them were soaked in it one minute and then removed and allowed to stand twenty-four hours. But in 1893 Chamberland and Fernbach found diluted and filtered chlorid

of lime solution so deadly to bacteria that they recommended it for house disinfection. They noticed that it was not so active upon dried bacteria, and so advised that rooms should be sprinkled with water before its use. In 1895 Delphine and Ransome found that when dried tuberculous matter was dipped in a 10 per cent. solution of chlorid of lime and then let stand for 17 hours it was thoroughly disinfected.

Jäger obtained good results with carbolic acid in the disinfection of tuberculous sputa. He used a 5 per cent. solution.

Gerlàch found that a 5 per cent. solution of lysol would kill the tubercle bacillus in three hours.

Springler, in 1891, found that he got good results with lysol only when he used a 10 per cent. solution and let it act for from five to twelve hours.

As to the use of sublimate solutions, at first, following the experiments of several, a 1-1000 solution was regarded as sufficient to completely destroy the tubercle bacillus, but later in 1892 Bordoni and Uffreduzzi found that this was too weak and not less than 3-1000 should be used, and it was safe to use as strong as 7 or 8-000.

In his own experiments Ottolenghi used tuberculous sputum of about the size of ordinary masses of expectoration and let it dry upon pieces of wood. He kept these in the dark or shielded from bright light while they dried, for he proved that bright light weakened and, after some hours, killed the bacilli. He sprayed these test objects with his disinfecting solutions and tested the results by injection into vigorous guinea pigs.

He found that a 5-1000 solution of sublimate was a perfectly safe and sure disinfecting material for tuberculous sputa, but a less strength not. He went into the matter of addition of sodium chlorid, tartaric acid, etc., to the sublimate solution, and came to the conclusion that a fresh solution was not benefited but rather hindered by such addition. He noticed the interesting fact that a water solution of sublimate loses considerably in disinfecting power by standing for some time and that such a solution loses power less rapidly if it has salts added to it.

Ottolenghi was looking for a good disinfectant and not so much for comparisons among them, so when he had proved sublimate to his own satisfaction he spent little time with others. He made one test only with 10 per cent. solution of formaldehyde, and the result was not satisfactory.

He got negative results with 10 per cent. solution of chloride of lime, but with 10 per cent. lysol solution he got as good results as with the sublimate. The author verified experiments of others as to

the destructive power of direct sunlight upon tubercle bacilli. He found that while sputa dried in the dark remained virulent for nearly 150 days, and that dried in diffuse light for 120 days, that exposed to direct sunlight was made sterile in from four to fourteen hours.

Action of Non-Disinfectants on Bacteria.

Otsuki, in Hygienische Rundschau, No. 4, 1900 (Centralblatt for September, 1900), gives experiments conducted to prove the action of the material upon which test bacteria might be placed, that is, whether or not it influenced the disinfection. Gepper and others have noticed that disinfection was easier upon some material than others. As test objects very active anthrax spores were used, and these were tested on silk threads, woolen threads, feathers, hair, silk cloth, leather, wood, filter paper, cotton, glass beads, cover glasses, garnets. These were soaked in bouillon containing the spores and dried at a very low temperature in desiccators, for thus he found their vigor was best preserved. He subjected them to free flowing steam, and found that those upon silk, woolen, feathers, hair, wood and paper were living after three minutes, those upon cotton after three and one-half minutes, while those upon glass beads were dead at the end of two and one-half minutes; those upon cover glasses at the end of one minute, and those upon the garnets at the end of one-fourth minute. He was unable to prove what the action of the garnets was due to. He tested the same objects in the same way with 5 per cent. carbolic acid and got analogous results.

Tests of Commercial Disinfectants.

In the "Boston Medical and Surgical Journal for December 21, 1899, No. 25, Dr. Charles Harrington gives an account of experiments made by himself and Dr. Pearce on the disinfecting power of several commercial disinfectants. The list included Marsh's Instantaneous Disinfectant, Disinfectine, Ozonos, Bromochloralum, Royal Disinfectant, Excelsior, Phenol Sodique, Hovey's Chloride of Zinc, Platt's Chlorides, Carbolic Purifying Powder, Solution of Chlorinated Soda. He used as test objects anthrax spores, typhoid stools, diphtheritic and tuberculous sputum. The disinfectants were intimately mixed with the tests and left for two hours.

In general they were not satisfactory. Not one of them sterilized tuberculous sputa. The substances contained in these disinfectants were chlorid of zinc, chlorid and sulphate of aluminum, alum, permanganate of potassium, salts of lead, iron and copper, neutral tar oils, hydrochloric and nitric acids. They tried also 5 per cent. solution of carbolic acid, and sulpho-napthol. The former sterilized the sputum but not the typhoid or diphtheritic material; the latter was a little more efficient, but not satisfactory.

A 1 per cent. formaldehyde solution (2½ per cent. formalin) was uniformly satisfactory with all test objects.

Tubercle Bacillus in Milk, Destruction of.

Bulletins No. 172 and 173 of the Michigan State Agricultural College are devoted to recommendations as to disinfection, and especially to the effect upon the tubercle bacilli of pasteurizing milk.

Common methods of disinfection are described and directions given for their practical use.

Their experiments show that the tubercle bacillus in milk is killed by pasteurizing at 68° C. (155 F.), provided care is taken to heat the milk to this temperature. They show that it takes quart bottles of milk fully thirty minutes after the surrounding water has reached this temperature to reach it themselves. The process is much more rapid at 70° C. (158 F.).

In Conclusion.

Many short articles and notes besides those reviewed in this paper have appeared in various medical journals, many of them relating to the work of practitioners of medicine. Obviously no mention need be made of papers read before this Association at its last two meetings, for they are in the hands of all members. It was my purpose to refer to articles only which gave accounts of actual experiments, and so I have omitted all mention of articles which simply give directions for disinfection based upon experiments of others.

It is evident from this review that much work is being done and sure progress being made. Each can draw his own conclusions from what has been given. It seems to me fair to state certain conclusions as warranted:

1st. Household disinfection after infectious diseases should combine use of formaldehyde with other means. It can be safely relied upon for all exposed surfaces and these only.

2d. Formaldehyde requires moisture enough in the air to nearly saturate it, for its most efficient working.

3d. There is much disagreement among experimenters as to the disinfection of tuberculous matter. One says a 2 per cent. solution of formaldehyde disinfects it, another that even a 10 per cent. solution does not. Several say that formaldehyde gas applied as above destroys it, others deny this. Further experiments are needed.

4th. Soap is a poor disinfectant, but 1 per cent. caustic alkali, or 20 per cent. carbonate of alkali is efficient.

5th. Carbolic acid less than a 5 per cent. solution has little disinfecting value.

6th. The kresols as used in kreolin, lysol, solutol, are safe disinfectants.

7th. Alcohol, at from 50 to 75 per cent., has considerable disinfecting power, but not at other strengths.

8th. Most metallic salts, except those of mercury, have little disinfecting action.

9th. Bichlorid of mercury or corrosive sublimate should be used in strength at least 5 to 1000 if tuberculous matter is to be disinfected. A fresh solution is more active than one which has stood for some weeks. The addition of salts does not increase the strength of a fresh solution, but prevents it from losing its strength as rapidly.

10th. Bright sunlight kills the tubercle bacillus in a few hours, and, as a rule, pathogenic bacteria keep their greatest virulence only when kept in the dark.

I do not mean to say that all these propositions are established, but simply that the experimental work reviewed tends to establish them. One other thing may well be said. We are learning more and more how difficult it is to disinfect under all conditions. It is seen to be not so easy as was once thought. The tendency is towards the use of stronger solutions and more radical measures. And yet it is only a repetition of what we see in higher life. Theoretically, a tornado like that at Galveston ought to have destroyed every life in the center of its activity, but it did not. Occasionally when a vessel goes down at sea all perish, but in the majority of cases there are survivors. So it is in disinfection. There are doubtless many individual bacteria who come unscathed through our most radical processes—as Virgil said Æneas and his shipwrecked sailors did, "Some on planks and some on pieces of the ships."

REPORTS OF SUB-COMMITTES.

RELATION OF BACTERIAL PRODUCTS (TOXINS, ETC.), TO DISINFECTANTS.

The sub-committee to which this topic was assigned made a brief report written by Dr. de Schweinitz. He reported that the literature of the subject was very scanty, he being able to find little of interest. He had himself instituted a number of experiments which as yet were not sufficiently complete to report. He could say, that, contrary to his previous belief, his experiments pointed towards a decided action of bacterial products upon disinfectants. If these first indications should be confirmed they would throw important light upon experimental work with disinfectants, accounting in some measure for variations in results which have been obtained. He and other members will continue work upon the matter.

STANDARD CULTURES AND METHODS OF USING THEM.

Dr. E. H. Wilson reports for the sub-committee that mercuric chlorid is recommended as the best standard disinfectant to which the others should be referred. The general scheme of work should be:

1. To determine the resistance of the standard culture to this, and the limit of error due to variability.

2. The resistance of other species in terms of this.

3. To compare other disinfectants to the standard.

The standard culture should be kept on plain agar at 37° C.; should be renewed every day, and a 24 hours culture used for experiment.

To make a test add two loops of culture to one-half c. c. steril. distilled water. Dip glass tubes in this and return these to tubes to dry (Hill's method). When dry, place in mercuric chlorid solution of known strength (2 grams in 1000 c. c. is recommended, this kept in green glass bottles.) Leave them in the solution for ten minutes at 20° C., then remove and transfer to a dilute solution of ammonium sulphid. After a few minutes take out, wash, and put in broth and incubate for one week. Staphylococcus pyogenes aureus is provisionally selected as the standard culture.

Bacteriologists are asked to criticise this and suggest improvements.

METHODS OF EXPRESSING CHEMICAL STRENGTH OF DISINFECTANTS AND WAYS OF DETERMINING THIS.

Dr. Leonard P. Kinnicutt reports for the sub-committee as follows. As yet we select the following:

Formaldehyde.
Mercuric chlorid.
Chlorid of lime.
Sulphurous acid.
Phenol.
Copper sulphate.
Zinc chlorid.
Quick lime.

In case of solutions express the chemical strength in grams per 100 c. c., except in case of mercuric chlorid, which should be expressed in parts per 1000 by weight. Further consider grams per 100 c. c. as per cent. solutions. In case of chlorid of lime the per cent. refers to grams of pure chlorid obtained by treating with dilute acid.

In case of gases diffused in a room express amounts in parts by volume in 1000 or parts by weight in one cubic meter.

In case of solids report grams in 100 by weight.

As to chemical methods use the following:

For formaldehyde the iodometric method of Romijin (Zeit für Anal. Chem., Vol. 36), (Journal Chem. Ind., 1897).

For mercuric chlorid the iodine method of Personne (Sutton's Vol. Anal. 1896, Comptes Rendus Vol. 54.)

For chlorid of lime, the iodometric method of Bunsen (Annal. der Chem. and Pharm., Vol. 86) (Sutton's Vol. 1896.) This may be used for hypochlorites in general.

For sulphurous acid, Bunsen's iodometric method. Sutton's Vol. 1896. (Journal Chem. Ind., 1884.)

For phenol Koppeschaar's method. (Sutton Vol., 1896.) Or if in powders see Allen's Commercial Organic Anal., 1900, Vol. 2 part 2.

For zinc chlorid use ferro cyanid method of Galette (Sutton's Vol.)

For copper sulphate use iodometric method of Brown (Sutton's Vol.)

For quick lime use sucrose method of Stone and Schneck (Journal of American Chem. Soc., 1894.)

For sulphur dioxid in air of room aspirate through bromine water and determine sulphuric acid formed.

WOMAN'S SANITARY WORK IN INDIANAPOLIS.

By HESTER M. McCLUNG.

Dr. G. M. Gould, in his curious religio-scientific work entitled, "A Search after Religion in Biology," advocates sanitation as a chief aid toward the attainment of a higher spiritual life.

Thomas Carlyle has said "The knowledge which a people possesses of the art of healing is the measure of its refinement and civilization."

Some one else has said, "Our present life is squarely grounded on the physical."

Coming down to about 1892, and approaching nearer the concrete details of the subject, the President of the British Medical Association said, "I wish to impress it upon you that the whole future progress of sanitary movement rests, for its permanent and executive support, upon the women of our land."

This allusion to women was made before the magical rejuvenation of the noisome cities of Havana and Santiago de Cuba under the administrations of such matchless men as Col. Geo. E. Waring, Jr., and Gen. Leonard B. Wood. Of course, no thought of woman, or woman's help, was connected with these magnificent achievements.

But the spirit of that ante-bellum, implied appeal to women found lodgment, like Longfellow's arrow, in the hearts of two excellent women, away off here in the inland city of Indianapolis, in February of 1893.

Threatening cholera imperiously directed their attention to the unsanitary condition of our city.

They believed that simple cleanliness was a far more effective barrier to infection than was quarantine. They believed, moreover, that any woman, who by inherited and lifelong habits is necessarily a housekeeper, has much more highly developed senses of sight and scent, particularly along unsanitary lines, than has the ordinary man.

ORGANIZATION.

They, therefore, with others, issued a call for a public meeting of women. Many responded, and an organization, known as "The Woman's Sanitary Society," was formed.

A glimpse at the personnel of this body of women will illumine the subject. Of the two originators, one was the quiet, retiring grandmother of the grandson of the then President of the United States.

The other was a lifelong instructor of literature. For many years she occupied the chair of literature in a nearby college, and to her wide-spread influence more than to any other one person Indianapolis is indebted for its reputation as a city of literary culture.

Others were dainty leaders or followers in the social life of the city. Others were women of substantial and acknowledged worth, whose full lives left little margin for social or club life, yet to whom this particularly important project appealed strongly. Indeed, women from all walks of life, colored as well as white, were represented. The one earnest purpose wrought a wondrous sense of kinship which engendered respect and appreciation of hitherto unknown phases of life; and all were equally benefited. The genuine hard work, much of which was necessarily fatiguing, exasperating, and pathetic, was lightened and made of untiring interest not alone by the consciousness of accomplishment, but by the inimitable wit and humor which continuously flashed out from unexpected sources in this democratic assembly.

Article II of this organization's constitution reads thus: "The object of this Association shall be to promote general sanitation by increasing public interest in the prevention of disease, and by aiding the city government in the enforcement of its sanitary ordinances." Its position came to be clearly defined as being that of an adjunct to the Board of Health; and its work has been acknowledged, and gratefully accepted by the various Health Boards that have come and gone during its continuous existence.

METHODS.

The work being new to all, many plans struggled for existence. Some of these seem crude indeed when viewed in the light of the present. But through a survival of the fittest suggestions, the following method of procedure finally crystalized: A chairman for each ward was appointed. In conjunction with her were two or more visitors, who were to use any polite, feminine method of learning the location of unhealthful accumulations in street, alley, yard, cellar or elsewhere. These nuisances were reported to the chairman of the ward, who, in turn, reported them to the Secretary of the Society; who, over her own signature, forwarded all such as were approved by the executive board, to the Health Board, Board of Public Works, Street Commissioner, or to whatever department of public service the nature of the report indicated its relationship. The Health Board kindly furnished the Society with reports in blank. These were filled out with the nature of the nuisance, the name of the street, the number of the house and the name and address of the owner or agent.

This specific information was very acceptable to the Health Board as thereby the abatement of nuisances was greatly expedited.

The plan of having the complaints pass successively through ward visitor, ward chairman, the Society's Secretary, the City Health Board and Sanitary Inspector, eliminated all ill feeling among neighbors, since thereby it was made impossible for the aggrieved citizen who harbored unsanitary accumulations to trace out and determine upon whom to vent his ill humor when he was requested by the Inspector to "clean up." One man getting an inkling of the source, asked the Health Board, "Who are those women that are making such a fuss about a little bit of dirt?" But he never found out.

WARD VISITORS.

The filed reports of the ward visitors show many interesting encounters. During a second visit to a family where a more cleanly yard had been suggested, the woman proudly exhibited an immaculate condition of the premises. The delighted visitor chanced to remark: "And you had all the rubbish carted away?" "Oh, no, Miss," was the innocent reply, "I swept it all clear away into the cellar." Others had thrown their garbage and everything else into the vault, or over the fence into the back alley. "Out of sight, out of mind" was their theory. The blessed innocence of these happy people was broken in upon, somewhat rudely perhaps, by the light of our present day ideas.

It is needless to say that tact, courage, wisdom, patience and indeed almost every virtue was brought into activity by the proper pursuance of this work.

In addition to the ward visitors, one lady was appointed as a general inspector. Her duties, however, becoming exceedingly arduous, the Society considered the advisability of employing a young medical student, or other suitable person, to take the work at a salary. The plan was abandoned, however, for, as the minutes state, "No outside person could be found who would bring to the service the invaluable knowledge, zeal and sympathy that are now so freely donated by our own excellent inspector."

AUXILIARY SOCIETIES.

Auxiliary societies were formed in various sections of the city whence reports were sent to the central society. At these meetings, addresses were made upon practical application of sanitary methods. A report of one of these meetings states that "a lady illustrated upon a blackboard the construction of a sewer-connected vault, clearly setting forth the evil resulting from the use of it as a receptacle for

cast-off clothing, old tin cans, or other obstructing rubbish." As this was in a tenement district the landlords as well as tenants were profited by the talk.

In the early days when the cholera excitement was still upon the city, 6000 health cards containing suggestions relative to cleanliness, disinfection and general care of health, were distributed among the children of the public schools. Like suggestions were constantly kept before the public through the press. The cholera fright proved to be a blessing in disguise, for we prolonged as far as possible the use of it as an irritant to the apathetic brain centers which were slow to respond to modern associations of sanitary ideas. In those days the fields were ripe for the harvest, but the laborers were few. One report says, "Numerically we are much too small for a city the size of Indianapolis, but we are very much alive." Another report from an auxiliary composed of colored people, whose zeal was specially commended by a sanitary inspector, states, "We have secured the cleansing of 210 vaults. Much more disheartening work remains to be done, but we *shan't give up*."

SELF EDUCATION.

There are few things that sooner bring a woman to realize her utter ignorance, than does the work in city sanitation. In the innocent ignorance of the early days we made some mistakes which we afterwards knew must have furnished amusement for the officials, but these gentlemen were so uniformly courteous, and they so kindly guided us into the proper channels, that we felt no sting. We soon acquainted ourselves, however, with the particular line of work done by each of the various administrative departments, and after a year or two of experience, we began to find our bearings and know our real value and power. Among the Society's papers are found the following helps to the technical education required: The City Charter. Rules governing the City Council, and the Boards of Health, Public Works, and Public Safety. Police Districts. Lists of Councilmen. Lists of School Commissioners. Rules for garbage receptacles, collection, separation and removal. Street sweeping specifications. City Map. Sewer System Map. Park Maps and Reports. Preventable disease circulars, health circulars and monthly bulletins of the State Board of Health. Report of State Public Health Officers. Sanitary Survey of Indianapolis. Purdue University Monograph from the Departments of Biology and Sanitary Science.

STANDING COMMITTEES.

With the acquirement of knowledge and skill the work became more and more systematized and we finally found ourselves with the

following Standing Committees: Garbage, Markets, Street Sweeping, Hospital and Dispensary, Schools and School Buildings, Anti-Expectoration, Parks, Literature of Sanitation, and Emergency. Into the hands of these committees passed almost the entire care of these phases of the work.

An off-hand resume of further interests which received attention, but for which no standing committees were appointed, includes the following:

Criminal negligence of physicians to placard houses wherein were contagious diseases.

Free disinfection of tenements of the poor.

Disinfection of physician's offices.

Disinfection of hacks used at funerals of those who died of contagious diseases.

Ventilation of street cars.

Ventilation of theaters.

Individual chalices for use in communion services.

Individual drinking cups in schools, railway coaches and elsewhere.

Promiscuous use of handkerchiefs among children.

Filthy money.

Uncovered meat conveyed in wagons about the streets, and fruits and vegetables exposed, outside of groceries, to the filthy dust of the highway.

Vacant lots.

Bakeries.

Pure water.

Public baths.

Catch basins.

Stable refuse.

Earth closets.

Closets in stores.

Tarpaulins for the dead animal wagons, and frequent disinfection of same.

Removal of snow from sidewalks.

Free car transportation for Sanitary Inspectors.

Bicycles for dispensary internes.

ORDINANCES.

In connection with other public influences our Society worked for the following ordinances:

Pure milk supply.

Vehicle tax.

Suppression of unnecessary noises.

Dodgers.
Smoke.
Weeds.
Expectoration.
Garbage.
Banana carts on central streets.
Vault connection with sewers.

LAWS.

Reconstruction of State Board of Health Law.
Food Adulteration.
Park Law.

LITERATURE OF SANITATION.

The Association made no pretense to literary effect, and yet no poem ever received more wrapt attention than did many of the reports read at these meetings. The Committee on Literature of Sanitation has in her reports opened up a wide field of interest, her investigations including an extended review of Dr. Albert Shaw's valuable works.

These reports became so alluring that a check was brought to bear upon this incidental phase of the work lest the real, genuine, practical "clarin-up time," as Aunt Cloe would say, should be lost to sight.

EMERGENCY COMMITTEE.

Public movements were closely watched, and the Emergency Committee had no hesitancy in acting promptly when an opportune letter, interview or press article, might give a desired trend to a project in its incipiency, where delay for a regular meeting of the board might endanger success.

THE PRESS.

The city press has been uniformly courteous. Our communications were never rejected, and when the editors were requested to keep before the public, for a time, such subjects as weeds, spitting, dumps, etc., etc., they cordially responded.

Indianapolis is designated the "City of Homes." Through this fact she has become a reading city—one of the many dailies finding its way to even the lowliest cottages in back alleys. The ward visitor so frequently heard of our little published articles that there grew up a strength-giving confidence that the leaven was working everywhere. One bright little mother in a six-dollar tenement referred to one of our articles which stated that "much less filth was found among the respectable poor than in the back alleys of the aristocratic sections, owing to the condition of the latter premises being trusted to careless

servants." This publicly expressed appreciation of such places as her own neatly kept domain engendered in her a sense of civic pride that was hopeful to contemplate, for she was only one of many.

The aim of the press articles was to uplift a higher standard of cleanliness rather than to deprecate wrong. The good citizen was urged to enter his complaint, not for the purpose of punishing his filthy neighbor, but to the end that he himself might secure his legitimate right to pure air, pure water and pure soil.

CITY OFFICIALS.

The workers who met with greatest success were sufficiently optimistic to base their communications to the various departments in the faith that all city officials are gentlemen and true citizens, until the contrary is proven. Our minutes record very few adverse criticisms of any city official; on the contrary, one report says, "The Board of Works must be earning its bread by the sweat of its brow, judging from the needed sewers and street repairs it has in hand." Another says, "Our city is splendidly equipped with earnest, hard-working officials." The minutes record a member's expression of impatience at the delay of the Health Board, in removing a certain nuisance. The president reminded the speaker of the lack of sufficient funds to procure enough sanitary inspectors, and added, "The Health Board is already too much burdened; it would need seven-leagued boots and far more than 24 hours a day to promptly meet all requests."

Politics had no place among us. At every change of administration, we requested the new mayor to make as few changes as possible; always asking specifically for the retention of the president of the Health Board, the City Sanitarian and the Hospital Superintendent.

Correspondence with the city officials was not confined to complaints of nuisances or like unpleasantnesses, but there often went to them letters expressing appreciation of the methods they were pursuing in different lines of progress. These letters were not of praise which belittles, but of appreciation which dignifies. The letter files show gratitude for these missives.

We rejected all petitions from would-be city employes for our aid in securing places that would necessitate the removal of good and efficient incumbents. This was done not alone because it would be "meddling with politics" against which we had been wisely warned, but because, as the minutes naively put it, "to grant such assistance would involve a violation of the civil service section of our charter." We also declined to furnish letters of recommendation to persons desiring to contract for city work; and we likewise refused to stand sponsor

for many who desired to advertise lectures or other entertainments as under the auspices of our Society.

There are few things that eliminate the fanciful, and all weak sentimentality, from a woman's mind more fully than does this municipal housekeeping. To those who desire to make a sensation, the field offers little allurement, for the very nature of the work requires that it be done unobtrusively. It has been the quiet, earnest individual work, the laborious, detail work that has accomplished results.

Yet, notwithstanding the fatigue incurred, notwithstanding the necessarily unpleasant nature of much of it, still a certain fascination attached to it all the while. A certain sustaining conservation of nerve energy obtained, because of the fact that our work was appreciated.

The president of the Health Board, in an address at a banquet devoted to sanitary science, in referring to the progress of the city, said, "Every citizen owes much to the Woman's Sanitary Society, which, by its unremitting and courageous work, has done much to preserve the health and educate the people to a knowledge and acceptance of sanitary regulations. The work of this Society, together with that of others in the same field has so educated the public, that the veriest vagabond is an apostle of sanitation."

Later, a leading daily had the following editorial: "One of the best works done by any woman's club in Indianapolis is that of the Woman's Sanitary Society, which takes an active hand in cleaning up the city and acts as a stimulus to the men in power, who feel complimented by the help of the ladies and join heartily with them in making Indianapolis what she is to-day—the cleanest city in the United States." These and other like commendations were ample reward from the outside. From within has come the reward of a consciousness of personal relationship to the municipality. A civic pride has come to life within us. We have been brought into direct touch with the administration. We have learned its needs and our power to help supply the same.

We "builded better than we knew" away back in 1893 when we chose as our aim "the increase of public interest" and tendered our "aid in the enforcement of sanitary ordinaces." These years have taught us that without the aid of a favorable public, no ordinance, however good, can be carried out. We have not only helped to secure a more "favorable public," but we have awakened to a realization that we, simple lay citizens that we are, and scarce that being "only women"—that *we* nevertheless, are genuine, bona fide, important, integral factors of that same "public" which aforetime was to us a great, far-off abstraction.

Has not this been enough?

REPORT OF THE COMMITTEE TO DEFINE "WHAT CONSTITUTES AN EPIDEMIC."

To the President and Members of the American Public Health Association—Gentlemen: A word of explanation is desirable as a preface to this report. At the meeting of the Association held at Ottawa in 1898, a paper was read calling attention to the fact that the word "epidemic" as used in legal documents was liable to misconstruction and abuse, and suggesting the inquiry as to whether the word was not susceptible of a definition which would avoid these unfortunate results. A committee was appointed to consider the question and to report at the next meeting. The definition proposed by that committee at the Minneapolis meeting was as follows:

"An epidemic is an outbreak of a communicable or infectious disease, affecting a dozen or more individuals in quick succession before the recovery of the first case, whether arising from a single focus or from several foci in a neighborhood."

This definition proved unacceptable and the subject was recommitted.

Your committee approaches the question, therefore, with considerable hesitation. The idea which the first committee desired to make prominent in the definition was that for the purpose of public health protection the number of cases of a contagious disease existing at any one time or the proportion of such cases to the population is a factor of small importance as compared with the nature of the infection and the degree of rapidity with which the disease is spreading, and that the attempt to establish a numerical proportion of cases to population as a basis of definition is, therefore, illogical and impracticable. With this thought the present committee is in accord. It desires, however, to offer the following suggestions:

The practical object in view was to remove the temptation to the health authorities of a community or state, influenced by the commercial element of the community to shield themselves under a mere technicality against criticism for failure to perform their full duty for the protection of both their own and other populations.

The action taken by the International Conference of Boards of Health at Toronto in the year 1886 with regard to the "Interstate Notification of the Existence of Infectious and Contagious Diseases," was evidently prompted by appreciation of this very difficulty. The resolutions open as follows:

"WHEREAS, It is necessary for the protection and preservation of the public health that prompt information be given of the existence of cholera, yellow fever, or smallpox, be it resolved:

1. That it is the sense of the National Conference of State Boards of Health that it is the duty of each state and provincial board of health within whose jurisdiction any of said diseases may occur to furnish immediate information of the existence of such disease to boards of health of neighboring states and provinces and to local boards of such states as have no central board."

An addendum adopted at Washington, the year following, provided that:

"2. In the instance of smallpox, cholera, yellow fever, and typhus, reports shall be at once forwarded, either by mail or telegraph, as the urgency of the case may demand.

3. In the instance of diphtheria, scarlet fever, typhoid fever, anthrax or glanders, weekly reports, when possible, shall be supplied in which shall be indicated as far as known, the places implicated and the degree of prevalence."

It will be observed that the existence of a single case of any of the diseases mentioned might be considered as sufficient ground for notifying other boards of the fact.

On the other hand, tuberculosis, the communicable nature of which is now universally admitted, is constantly present in all our northern cities to a much greater extent than is required by the numerical standard adopted by the Medical and Surgical Association of New Orleans, in order to constitute an epidemic, and yet the idea of making it the subject of interstate notification has never been broached.

At the time when the word in question crept into legal phraseology and the regulations of Boards of Health, the medical profession recognized what was called an "epidemic constitution of the atmosphere." By this was meant that the entire atmosphere of a neighborhood had become saturated with the poison of an infectious disease, or had acquired some occult property which enabled it to propagate infection. Of the nature of this poison or property no very definite idea was entertained or at least generally accepted. When, therefore, disease was officially declared to be epidemic in a place, the meaning intended to be conveyed was that the air of such place was in so poisonous a condition as to make it probable that a stranger visiting the town would, simply by breathing the air, and without exposure to or contact with those sick of the disease, or with articles which had been exposed to the sick, himself contract the disease, and further that the clothing and effects of all persons living in this atmosphere had become infected to a greater or less extent and were liable to convey the infection to other places. The more definite knowledge which we now possess as to the mode of propagation of communicable diseases, based upon the discovery and acceptance

of the germ theory, has led the abandonment of this conception, and the phrase referred to is fast disappearing from medical literature.

It cannot be denied, however, that in the minds of the public at large, and indeed of many of the profession, the word epidemic still conveys this idea of universal atmospheric contamination. This is greatly to be deplored because, while on the one hand its use inspires an indefinable horror and creates panic, on the other it leads to the disregard of the very precautions which are of essential use in restricting the spread of the contagion, viz: those which should be taken in regard to the person and excreta of the patient, his effects and his immediate environment.

Is it too much to say, then, that this word, in view of our changed views as to the propagation of communicable diseases, has outgrown its usefulness? Nay, more, that it has become the means of perpetuating false conceptions and that its official use may be misleading and mischievous? Without attempting, therefore, any stricter, more comprehensive or more lucid definition of this word, we beg leave to recommend that, as opportunity occurs, in all laws and regulations in which certain executive action is made contingent on the declaration by the health authorities of the existence of an epidemic, the phraseology shall be altered by omitting the word "epidemic" and in place thereof inserting a brief statement of the condition calling for such action, as for example,

"Whenever a communicable disease prevails to such an extent or is spreading with such rapidity as, in the opinion of the Board to make its duty to notify either the general public or the authorities of neighboring towns of the fact," such and such action shall be taken.

Of course a better alternative statement may be suggested.

Your committee respectfully requests to be discharged.

Respectfully submitted,

(Signed.) Benjamin Lee, Chairman.
Wm. C. Woodward.
Elzear Pelletier.
Samuel H. Durgin.
Arthur R. Reynolds.

ARE NATIONAL LEPROSARIA IN THE UNITED STATES DESIRABLE?

By H. M. BRACKEN, M. D.,

Chairman Committee on National Leper Home.

In order to answer this question intelligently it is necessary to make a careful study of leprosy. Early in the year I sent a circular letter to the various Provincial and State sanitary authorities asking for information regarding leprosy within their jurisdictions, and also asking their opinion as to the best method of caring for lepers. The information returned is given in condensed form in the table on the following page:

Three provinces and fourteen States report having had lepers to deal with. Other States undoubtedly belong in this list. It has been possible for me to make a somewhat careful study of leprosy in the Northwest. This report will therefore be given in four parts. The first part will relate to cases of leprosy reported officially from five States, viz., Iowa, Wisconsin, Minnesota, North Dakota and South Dakota. The second part will relate to the cases of leprosy reported officially from a few other States. The third part will give the history of a few cases of leprosy of which I have knowledge through private information. The fourth class includes five cases, some of whom may have been already reported in parts one or three. The possibility of duplication in dealing with these cases is so strong that I have preferred reporting them as a distinct class. The location in which the official cases have, or had, residence is given. The non-official cases, for evident reasons, cannot be located.

OFFICIAL LIST OF LEPERS.

Case 1. This patient's mother was recognized as leprous two years before she gave birth to this child, and was placed in a leprosarium in Norway, where she died four years after her disease was recognized. The father married again (whether in Norway or the United States is not stated), and settled on a farm in Iowa. Tubercular leprosy appeared in this child when six years old, and she died at the age of eighteen. She lived at home, and, although quite strictly isolated, was probably better cared for and happier than she could possibly have been in a leprosarium. She slept and ate by herself, but was not excluded entirely from association with other members of the family.

TABLE.

Name of Province or State.	Is there any Record of Lepers within your Jurisdiction?	How Have They Been Cared For?	What Future System for the Care of Lepers would you Suggest?	Name of Reporter.
Manitoba	Yes.	At a national lazaretto....	National	
New Brunswick	Yes.		"	
Nova Scotia....	Yes.		"	Dr. A. P. Reid.
Ontario	No.		"	Dr. P. H. Bryce.
Quebec	No.		"	Dr. E. Pelletier.
Arkansas	No.	No system ...	"	Dr. R. B. Christian.
California.....	Yes.	County care..	"	Dr. W. P. Mathews.
Colorado	No.	No system ...	"	Dr. G. E. Tyler.
Connecticut....	No.	" " ...	National or state .	Dr. C. A. Lindsley.
Delaware	No.	" " ...	National	Dr. A. I. Lowber.
Illinois	No.	" " ...	State and national	Dr. J. A. Egan.
Indiana	No.	" " ...	National.....	Dr. J. N. Hurty.
Iowa	Yes.	Isolation at home	National	Dr. J. F. Kennedy.
Kansas..	No.	No system ...	"	Dr. W. B Swan.
Kentucky	No.	" " ...	County care	Dr. J. N. McCormack.
Louisiana.....	Yes.	State care....	National	Dr. G. F. Patton.
Maine	No.	No system ...	"	Dr. A. G. Young.
Maryland	Yes.	" " ...	"	Dr. J. S. Fulton.
Massachusetts .	No.	" " ...	National or state .	Dr. S. W. Abbott.
Michigan	No.	" " ...	No suggestion to offer.....	Dr. H. B. Baker.
Minnesota	Yes.	Isolation at home	National	Dr. H. M. Bracken.
Mississippi	No.	No system ...	"	Dr. J. F. Hunter.
Nebraska	No.	" " ...	"	Dr. F. B. Crummer.
New Hampshire	No.	" " ...	No suggestion to offer.	Dr. I. A. Watson.
New Jersey	Yes.	County care..	No suggestion to offer.....	Dr. Henry Mitchell.
New Mexico....	No.	No system ...	National.....	Dr. T. P. Martin.
New York.....	Yes.	" " ...	Probably national	Dr. B. T. Smelzer.
North Carolina.	No.	" " ...	National	Dr. R. H. Lewis.
North Dakota ..	Yes.	County care..	"	Dr. H. D. Quarry.
Ohio	Yes.	No system ...	"	Dr. C. O. Probst.
Oklahoma	No.	" " ...	"	Dr. L. H. Buxton.
Pennsylvania ..	Yes.	City.....	"	Dr. Benj. Lee.
Rhode Island...	No.	No system ...	National or state .	Dr. G. T. Swarts.
South Carolina.	Yes.	" " ...	No suggestion to offer.....	Dr. T. G. Simons.
South Dakota ..	Yes.	County.....	National.....	Dr. A. E. Clough.
Tennessee.....	No.	No system ...	"	Dr. J. A. Albright.
Texas	Yes.	Sent to Louisiana	State	Dr. W. T. Blunt.
Vermont	No.	No system ...	National	Dr. J. H. Hamilton.
Virginia	No.	" " ...	"	Dr. P. A. Irving.
Wisconsin.....	Yes.	Isolation at home	"	Dr. U. O. B. Wingate

Part I.—Lepers reported officially from Iowa, Wisconsin, Minnesota, South and North Dakota.

No.	State.	Nationality.	Disease Appeared Abroad.	Date of Birth.	Date of Death.	Type of Disease.	Pecuniary Condition.	Initial of Patient.
1.	Iowa.	Norwegian	Yes..	1880	1899	Tubercular	Good	C. P.
2.	"	"	"	.....	.....	.....	.....	
3.	"	"	"	.....	.....	.....	.....	
4.	Wis..	"	"	.....	.....	.....	.....	M. M.
5.	"	"	"	....	1897	Tubercular	Poor.	H. O. G.
6.	"	"	.....	.....	.....	.....	.....	O. S.
7.	"	"	.....	.....	.....	.....	.....	G.
8.	"	"	. ....	1898	1898	Anæsthetic	Poor.	T. L.
9.	"	"	Yes..	1839	L'v'g	"	Good	J. P.
10.	"	Swedish ...	"	1853	"	Tubercular	"	A. M. L.
11.	Minn.	Norwegian	"	1831	1880	Anæsthetic	.....	
12.	"	"	"	1822	1878	Tubercular	.....	
13.	"	"	No...	1843	1878	Anæsthetic	.....	
14.	"	"	"	1846	1876	Tubercular	Good	K. A.
15.	"	"	"	1848	1878	"	"	T. A.
16.	"	"	Yes..	1815	1877	"	.....	
17.	"	"	"	1848	1868	Anæsthetic	.....	
18.	"	"	No...	1825	1885	"	.....	
19.	"	"	"	1854	1885	Tubercular	.....	
20.	"	"	"	1839	1884	Anæsthetic	Poor.	
21.	"	Swedish ...	"	1853	1886	"	.....	
22.	"	Norwegian	"	1826	1888	.....	.....	
23.	"	"	.....	1851	1888	Tubercular	Poor.	
24.	"	Swedish ...	Yes..	1831	1889	"	Fair.	O. E.
25.	"	Norwegian	No...	1862	1889	"	Poor.	S. B.
26.	"	"	Yes..	1849	1890	Anæsthetic	"	E. N.
27.	"	"	"	1842	1890	Tubercular	.....	C. K.
28.	"	"	.....	1816	1896	"	Fair.	O. H.
29.	"	"	.....	1814	1892	"	"	E. A.
30.	"	"	Yes..	1830	1899	Anæsthetic	Good	J. P. S.
31.	"	"	"	1840	1896	"	Poor.	C. J. K.
32.	"	"	"	1848	1896	"	.....	T. N.
33.	"	"	"	1820	L'v'g	"	Poor.	H. O. S.
34.	"	"	.....	1834	1900	Tubercular	Good	A. B.
35.	"	"	.....	1857	1894	"	.....	N. O. H.
36.	"	"	Yes..	1838	189.	"	Good	M. J. M.
37.	"	"	"	1840	L'v'g	Anæsthetic	Poor.	A. M.
38.	"	"	"	1843	1897	"	... .	J. I. S.
39.	"	"	.....	1864	1899	Tubercular	Fair.	I. J. P.
40.	"	"	Yes..	1850	189.	Mixed	Poor.	J. S.
41.	"	"	.....	1850	1892	Tubercular	.....	A. R.
42.	"	"	....	1826	1895	Anæsthetic	Poor.	M. T.
43.	"	"	.....	.....	189.	"	.....	H. G.
44.	"	"	Yes..	1871	189.	Tubercular	Poor.	G. H. B.
45.	"	"	.....	1851	189.	"	"	J. O. B.
46.	"	"	.....	1867	L'v'g	"	"	J. T. H.
47.	"	"	Yes..	1852	Dead.	"	.....	L. P. V.
48.	"	"	.....	1860	L'v'g	Anæsthetic	Fair.	F. E. M.
49.	"	"	Yes..	1853	1897	Tubercular	Poor.	F. J. R.
50.	"	Swedish ...	"	1845	1894	"	.....	B. F.
51.	"	"	"	1845	1897	"	Good	A. M. O.
52.	"	Norwegian	.....	1860	Gone	Mixed	Fair.	J. M.

Part I.—*Continued.*—Lepers reported officially from Iowa, Wisconsin, South and North Dakota.

No.	State.	Nationality.	Disease Appeared Abroad.	Date of Birth.	Date of Death.	Type of Disease.	Pecuniary Condition	Initial of Patient.
53.	"	Swedish....	.....	1865	L'v'g	Tubercular	Poor.	M. H. D.
54.	"	Norwegian	.....	1867	1897	Anæsthetic	"	I. H. W.
55.	"	"	.....	1843	L'v'g	Mixed	Fair.	L. B.
56.	"	Swedish....	.....	1861	"	Tubercular	"	O. G. E.
57.	"	"	.....	1858	"	Mixed	Good	J. P. L.
58.	"	Norwegian	Yes..	1862	1890	Anæsthetic	"	B. O.
59.	"	Swedish....	.....	1845	1900	Mixed	Fair.	C. P.
60.	"	Norwegian	Yes..	1863	1898	Tubercular	Good	L. B.
61.	"	"	.....	1843	L'v'g	"	.....	E. J.
62.	"	"	No...	1856	"	Mixed	Poor.	O. K. K.
63.	"	Swedish....	"	1856	"	"	"	J. E.
64.	"	Norwegian	"	1845	"	Tubercular	Good	O. T.
65.	"	"	Yes..	.....	"	Mixed.....	Fair.	C. D. D.
66.	"	"	"	1828	1899	Anæsthetic	Poor.	O. J.
67.	"	"	"	1856	1898	Tubercular	Fair.	G. P.
68.	"	"	.....	.....	L'v'g	"	.....	O. T.
69.	"	"	Yes..	1869	"	"	Fair.	M. A.
70.	"	"	No...	.....	1895	"	Good	C. N.
71.	"	"	Yes..	.....	Gone	Anæsthetic	Fair.	G. A.
72.	S. D..	"	.....	1878	L'v'g	Tubercular	Poor.	B. T.
73.	N. D..	"	.....	1847	"	"	"	S. A.
74.	"	Swedish....	.....	1870	"	"	"	J. O.
74*a*	"	Norwegian	.....	1886	"	Not Lepro'y	Good	E. B.

Part II.—Lepers reported officially from other states than above.

75.	Pa...	Maryland..	.....		1900	Tubercular	Poor.	M. S.
76.	"	Pennsylv...	.....	1822	L'v'g	Mixed	"	C. P.
77.	"	Swedish....	.....	1850	1900	Tubercular	"	J. A.
78.	"	Pennsylv..	.....	1856	1900	"	"	A. D. W.
79.	"	Chinese....	.....		1897	.....	"	H. Y.
80.	"	"	.....		Dead	Tubercular	"	J. W.
81.	N. J..	"	.....		"	.....	.....	
82.	Ohio.	?	.....		.....	.....	.....	

Part III.—Unofficial list of Lepers.

No.	Nationality.	No.	Nationality.	No.	Nationality.
1.	Mexican.	10.	Icelandic.	19.	Icelandic.
2.	American.	11.	"	20	"
3.	Chinese.	12.	"	21.	"
4.	Greek.	13.	"	22.	Chinese.
5.	Norwegian.	14.	"	23.	Norwegian.
6.	"	15.	"	24.	"
7.	"	16.	"	25.	"
8.	"	17.	"		
9.	"	18.	"		

Part IV.—Possible Duplicates.

No.	Nationality.	No.	Nationality.	No.	Nationality.
A.	Norwegian.	C.	Icelandic. ?	E.	Chinaman.
B.	"	D.	"		

Summary of Cases Reported.

Official	82
Non-official	25
Possible duplicates	5
Total	112

Neither an older sister (born before the mother showed evidences of the disease) nor step-sisters have leprosy.

Cases 2, 3 and 4. I have so far been unable to obtain a full record of these cases.

Case 5. This man, a Norwegian, died in 1897. He was married, and his widow and children (four) are living and healthy. He came to America about 1884, and showed slight symptoms of tubercular leprosy at that time. His general condition towards the end was bad. He was a county charge, and there was more or less complaint in the community concerning the methods of quarantine pursued. His life was not made more tolerable by such unnecessary complaints.

Cases 6 and 7. Of these I have no records.

Case 8. This man, a Norwegian died in 1898. His age at the time of death is not given. His mother was recognized as leprous when he was twelve years old. His was of the anæsthetic type. He was poor and a county charge; was never married. He was a sufferer for years. Undoubtedly his life might have been made more tolerable had he been properly cared for.

Case 9. This man, a Norwegian, still living, is about sixty-six years old. He is married and has several grown children. The wife and children are all free from leprosy. His is the anæsthetic form of the disease, and has been present for probably twenty-five years. His hands and one foot are deformed. One leg has been amputated, and the sight of one eye is lost. Financially he is comfortably well off, and is cared for by his wife and married daughter.

Case 10. A Swedish woman, still living, aged forty-two years. She is said to be single, and to have the tubercular form of the disease, which is now in the advanced stage. She is said to have had leprosy since birth. She is cared for at her home, in a secluded manner, and is comfortable.

Case 11. A male (Norwegian), died at the age of forty-nine, in 1880. His was the anæsthetic form of leprosy, from which he is said

to have suffered for a period of twenty-four years. He was a resident in the United States nineteen years. The financial condition or general surrounding of this patient are not known. One maternal great-uncle was leprous.

Case 12. A male (Norwegian), died at the age of fifty-six, in the year 1878. He is said to have had the tubercular type of leprosy, and is also said to have been ill fourteen years, the disease appearing, according to the records, ten years after his arrival in this country. Nothing is known of this man's financial condition or the system pursued in caring for him. He had a leprous cousin, but no other leprous relatives are noted.

Case 13. A male (Norwegian), died at the age of thirty-five, in 1878. He had the anæsthetic type of the disease for a period of ten years, nine of which were said to have been spent in this country. Nothing is know of the financial condition or care given this patient. A paternal uncle was recognized as leprous.

Cases 14, 15 and 29. These may well be considered together. They were three brothers, born in Norway. The father died of leprosy. In 1864 an older brother sent for his widowed mother and her other children (three sons and one daughter) to come to Minnesota. These three sons all died of tubercular leprosy, one in 1876 (Case 14), the second in 1878 (Case 15), and the third in 1892 (Case 29). The first two were married, but left no children. Both widows married, and are still living and well. The third was never married. The first two were probably as well cared for at their homes, on a farm, as they could possibly have been at a leprosarium. The third lived in a small city. He had been in business, and was a general favorite. When the disease became well marked and revolting he was tolerated as a stranger would not have been. The mother, the oldest brother and the sister (younger than Cases 14 and 15) escaped infection. The mother died at the age of eighty-seven. The brother and sister are still living.

Case 16. This man, a Norwegian, died at the age of sixty-two, in 1877. His disease was recognized as of the mixed type. It had existed for a period of thirty years, the last twenty-one of which were passed in this country. Nothing is known of the surroundings or care of this patient. His brother and a paternal uncle were recognized as lepers, living presumably in Norway.

Case 17. This man, a Norwegian, died at the age of thirty, in 1878. His disease was of the anæsthetic type. Its duration is not given, neither have we any knowledge of the care he received or of his surroundings. A maternal uncle is said to have been leprous.

Case 18. This man, a Norwegian, died at the age of sixty, in 1885. He was one of the lepers seen by Prof. Wm. Boeck of Christiana when here in 1869-70. His was the anæsthetic form of the disease, and it had existed for a period of at least twenty years. He was resident in the United States twenty-nine years.

There is no further record of this case, except that he belonged to a decidedly leprous family in Norway, his father, a paternal aunt, brothers, sisters and cousins being recognized as leprous.

Case 19. This patient, a woman, died at the age of thirty-one, in 1885. Her nationality is not given, but she was presumably a Norwegian. The disease was of the tubercular form, and is noted as having been present for nine years and having made itself manifest nine years after she came to America. She was in the United States eighteen years. Nothing more in the history of this case is given.

Case 20. This man died at the age of forty-one, in 1885. His nationality is not given, but he was presumably a Norwegian. His was the anæsthetic form of leprosy, and the records state that it was recognized eleven years before his death. He was resident in the United States sixteen years. Nothing more is known of this case.

Case 21. This man, from Sweden, died at the age of thirty-four years, in 1886. His was the anæsthetic form of the disease, and its duration is said to have been about ten years. He became a county charge. He was not married.

Case 22. Of this man there is no record, further than that he was a Norwegian, that he died at the age of sixty-two, in 1888, and that he was married. His home had been in the country.

Case 23. This man, a Norwegian, died at the age of thirty-seven, in 1888. His was the tubercular form of leprosy. The duration of the disease is not known. He was poor and had some financial aid from the city in which he lived, but he remained at home and was well cared for by his wife. The attending physician informs me that the patient had two children, aged respectively about fourteen and fifteen years, both bright and in attendance at the public schools. His home was a sample of neatness. Neither his wife nor children showed any evidences of the disease.

Case 24. This man, a Swede, died at the age of fifty-eight years, 1889. His was probably the tubercular form of the disease, although it is not so stated by the reporter. He was married, and of his eight children seven are still living, ranging from twenty to forty years of age. The widow is also still living. None of these show any signs of leprosy. He was cared for at home. No facts are available as to his financial condition or general surroundings dur-

ing his long illness. It is said that the disease was recognized soon after his arrival in this country, in 1881.

Case 25. This man, a Norwegian, died at the age of twenty-seven, in 1889. His was the tubercular form of the disease. It is not known how long the disease existed. The man was single and of the ne'er-do-well type. When he became helpless he became a county charge, and died in a "pesthouse," where the care given him was not that of a modern hospital.

Case 26. This man, a Norwegian, died at the age of fifty-one years, in 1890. His was the anæsthetic form of the disease. The disease is said to have been present for twelve years. There is no record of this man or his surroundings, further than that he was married. His death certificate was signed by a coroner, so I presume a properly equipped and conducted leprosarium might have been an improvement upon the place in which he spent his last days.

Case 27. Of this man there is no record further than that he was a Norwegian, and died at the age of forty-eight, in 1890. His was the tubercular form of the disease, said to have been in existence thirty years, and to have appeared twelve years before he came to America.

Case 28. This man, a Norwegian, died at the age of seventy-nine years, in 1895. His was the tubercular form of the disease. It was recognized first twenty-two years before his death, and seven years after his landing in America.

He had a comfortable home and was well cared for. Five children are living, none of whom show any signs of the disease.

Case 30. This man, a Norwegian, died at the age of sixty-nine, in 1899. His was the anæsthetic form of the disease. He came to America in 1874, and had been recognized as leprous since 1860. He is said to have been self-supporting. I have no knowledge of his surroundings or general care.

Case 31. This man, a Norwegian, died at the age of fifty-six years, in 1896. His was the mixed form. The disease is said to have first appeared in 1858. He came to America in 1871. He was a single man, and lived alone in a hut not far from his brother. He is described as having been "hideous" to look upon. Both lips, the nose and all the fingers were gone. Both lower eyelids were everted. Tubercles were present in various parts of the body. The latter days of this patient must have been of a character hard to realize. Truly a leprosarium would have been a blessing to him.

Other members of this man's family showed no evidences of the disease.

Case 32. This man, a Norwegian, died at the age of forty-eight, in 1896. His was the anæsthetic form of the disease. There is no record of its duration or of the general surroundings of the patient. His father died a leper in this country (Case A), as did also one brother (Case 70). He left a widow and five children, none of whom have ever shown evidence of the disease.

Case 33. This man, a Norwegian, is still living, at the age of eighty (1900), His is the anæsthetic form of the disease. He has been a sufferer for many years, and is most emphatically a case for a well-cared-for leprosarium.

Case 34. This man, a Norwegian, died at the age of sixty-six years, early in 1900. His was the tubercular form of the disease, and had been known to exist for sixteen years. He was a farmer, in comfortable circumstances, and was well cared for by his wife and one son, who lived at home when I visited him in 1899. His room was neat and well kept. He was as comfortable as possible for one confined to bed with tubercular leprosy to be. The disease was loathsome to look upon. At present his widow and six children (all grown) are living. None of theses show any signs of leprosy.

Case 35. This man, a Norwegian, died at the age of thirty-seven years, in 1894. His was the tubercular form of the disease, and had been present for at least nine years. There is no record of this man or his surroundings, but it is probable that he was living on a farm and was taken care of at home. His wife and three children were reported as free from any evidences of the disease in 1898.

Case 36. This man, a Norwegian, died at the age of about fifty-three years. His was of the tubercular form. Nothing is known of the care he received, but probably he was well cared for at home. He was ill about ten years. His wife and two daughters were reported as in good health in 1898. Both daughters are school teachers.

Case 37. This woman, a Norwegian, is still living, at the age of sixty years. The disease is of the anæsthetic type and is said to have been present since 1870. She is not careful or cleanly in her habits, and is a proper case for a well-regulated leprosarium. She came to Minnesota from Wisconsin.

Case 38. This man, a Norwegian, died at the age of fifty-three, in 1897. His was the anæsthetic form of the disease, and was known to have been present for twelve years before his death. I have no history of his surroundings. His wife and three children were reported in 1898 as free from any evidences of leprosy.

Case 39. This man, a Norwegian, died at the age of thirty-five, in 1899. His was the tubercular form of the disease, and it is said to

have first appeared in 1882. Although a leper, he, a laboring man, took care of himself in a city until shortly before his death.

Case 40. This man, a Norwegian, died when over fifty years of age, some time after 1890. His was probably the mixed form of the disease, and was of long standing. He was poor and should have been cared for in a leprosarium. His widow married again. She and his child (a boy) have never shown any evidences of this disease.

Case 41. This woman, a Norwegian, died at the age of forty-two, in 1892. Hers was the tubercular form of the disease. She was married, but there is no record of her having had any children. The disease is said to have been present for eighteen years. Nothing is recorded as to how she was cared for.

Case 42. This man, probably a Norwegian, died at the age of sixty-nine, in 1895. His was the anæsthetic type of the disease. It had been known to be present for at least twenty years. He was a county charge for many years, and a leprosarium would have been the proper place for him. He was not married.

Case 43. This woman, probably a Norwegian, died some time after 1890. Hers was the anæsthetic form of the disease. Its duration is not known, nor do the records show how old she was at the time of death. She came to Minnesota from Wisconsin. She was married and had three or four children, all of whom were reported healthy in 1898. Her general surroundings are not recorded.

Case 44. This woman, a Norwegian, was a leper when she came to America in 1890. After staying here two or three years she returned to Norway, where she died. She was single. There is no record as to how she was cared for in this country. She is said to have been poor.

Case 45. This man, a Norwegian, was recognized as leprous about 1886. He was then thirty-five years old, and had been in America about four years. He was married and had at that time three or four children living. His was the tuberculous form of the disease. He was poor. About 1892 he was sent back to Norway, where he died later.

Case 46. This man, a Norwegian, is still living. He was born in 1867, and was known to be leprous in 1890. His is the anæsthetic form of the disease. He is single and poor, and should be in a leprosarium.

Case 47. Of this man, a Norwegian, but little is known. His was the tubercular form of the disease. He was first reported to the Minnesota State Board of Health as leprous in 1892. He had been unable to work for four years. The disease is said to have appeared in 1884, the same year that he landed in America. This means sim-

ply that he came to America a leper. In all probability he is dead, for repeated attempts have failed to find him. There is no record as to his pecuniary condition. He was born in 1852.

Case 48. This man, a Norwegian, is possibly living still, but it has been impossible to get any trace of him during the past three years. He was born in 1860, and was recognized as leprous in 1890. He was then a married man, with a wife and three healthy children. He is said to have been in comfortable circumstances, and to have had the disease in mild form—anæsthetic.

Case 49. This man, a Norwegian died at the age of forty-four, in 1897. His was the tubercular form of the disease. It had been recognized as present for at least twenty-four years. He was poor and a proper case for a leprosarium. He was single.

Case 50. This woman, from Sweden, died at the age of forty-seven, in 1894. She was recognized by a noted leprologist as leprous in 1893, the disease being of the tuberculous type. In spite of this the physician who attended her in her last illness (pneumonia) stated that he did not think she had leprosy. This simply illustrates the ease with which the disease may be passed over by the ordinary practitioner. She was married and had six children, all of whom were in good health in 1898. There is no record of her financial condition or the means employed to care for her.

Case 51. This man, from Sweden, died at the age of fifty-two, in 1897. The disease is said to have first appeared in 1892. It was of the tubercular type. He was comfortably fixed financially, and was well cared for at home. He left a widow and four or five children, all reported healthy in 1898.

Case 52. This man, a Norwegian, was born in 1860, and was recognized as a leper in 1889. He lived in Chicago at one time, but came to Minnesota for treatment by a Norwegian physician familiar with leprosy. His was of the tubercular type. He had a hard experience when he first came to Minnesota. He was practically chased from one place to another, until finally concealed for a time. The people tried to send him back to Chicago, but the car in which he was traveling was sidetracked at La Crosse, and from here he was finally removed by wagon a distace of over one hundred miles, into a safe place, and under the care of a kind-hearted physician. The physician who had him in charge died, and it is said the patient then found his way to Norway and entered a leprosery. Whether he is still living is not known. He has sufficient means to pay his way comfortably, and if he had not been persecuted his life might have been made tolerable. His case illustrates the needs of leprosaria as a refuge for unfortunates.

Case 53. This woman, from Sweden, was born in 1865, and is still alive. She came to America in 1887, and soon afterward married a Norwegian. In 1889 leprosy appeared. She is an exceedingly neat woman, and does everything in her power to prevent any possible infection of her family. Hers is the tubercular form of the disease. She has four children, two born before the disease appeared, two since. All of these, as well as the husband, were free from any symptoms of leprosy when seen by me in March, 1897. The oldest child was of age to enter the public school, but the sentiment against leprosy was so great as to exclude her, although perfectly well. The husband was a carpenter, and it was almost an impossibility for him to secure work because of his wife's disease. The poor woman was longing for death to come in order that the persecution of her family on her account might cease, but she is still suffering, not only physically but mentally. What a refuge a leprosarium would have been to this poor woman! She would then not only have had good medical care and nursing, but the ostracism of her family would have ceased.

Case 54. This man, a Norwegian, died at the age of thirty, in 1897. His was the anæsthetic form of the disease. The records show nothing for this man further than that he was single and poor. Undoubtedly a leprosarium would have been the proper place for him.

Case 55. This man, a Norwegian, is still living, aged fifty-seven years. He has the anæsthetic form of the disease, which first made its appearance in 1874 or earlier. He is single and a county charge. When first seen by me, in 1898, he was serving as a school janitor, but when the nature of his disease became known he could no longer get employment. He is much crippled. A leprosarium would be a great blessing to this man. He says he had no leprous relations, but had leprous neighbors in Norway.

Case 56. This man, from Sweden, is living, aged thirty-nine years, and is able to support himself; but the time will soon come when he will become a public charge, and then he will probably be given the privilege of dying at a "pesthouse." His is the tubercular form of the disease. It made its first appearance in 1892, and was then diagnosed as syphilis. He has a wife and two children, aged thirteen and ten years, all living and free from any symptoms of leprosy. A leprosarium will be the proper place for this man soon, although his condition has not changed much for the worse during the past two and a half years. He was associated with lepers as a lumberman in Sweden.

Case 57. This man, from Sweden, is living, aged forty-two years. His is the tubercular form of the disease. It is said to have first made its appearance in 1888, six years after his landing in America.

He is comfortable, in his own home on a farm, well cared for by his wife. He has four children, all girls. The wife and children show no signs of leprosy. The neighbors seem sensible, and there is no tendency to ostracise the family. He is a fortunate leper.

Case 58. This woman, a Norwegian, died at the age of twenty-eight, in 1890. Hers was the anæsthetic form of the disease. She had been in a leper hospital in Norway, and her relations state that she was discharged, "cured." The disease first appeared in 1874, when she was twelve years old. She came to America in 1887. She died of pneumonia, after one month's illness. She was never known as a leper in the community where she lived in this country. Her home was comfortable, and she was well cared for. She was not married.

Case 59. This woman, from Sweden, died at the age of fifty-five years, but a few days ago. Hers was the mixed type of leprosy. It first appeared as the anæsthetic type, in 1886. She was married and had six children, two of whom (girls) are still living, as is also the husband. None of these show any symptoms of leprosy. If there was a chance for infection it would seem as though it might have occurred in this family, for the woman was filthy in her habits. Fortunately her husband and children had a dread of the disease, and this served as a safeguard. Even in this favored state I would not have been willing to have taken a chance against contracting this disease while living in this woman's home. A leprosarium was the place for this patient, but she is beyond its benefits now.

Case 60. This man, a Norwegian, died at the age of thirty-five, in 1898. His was the tubercular form of the disease. It is said to have first appeared in 1888, but this was the year that he came to America. He was married and had one child. His wife was devoted to him, and he could not have had better care than that given him during his last illness. Neither his wife nor child show any signs of leprosy. A leprosarium would have been of no benefit to this leper.

Case 61. This man, a Norwegian, is still living, aged sixty-seven years. His is the tubercular form of the disease. He is married, and has eight children. Neither his wife nor children show any signs of the disease. He is quite well cared for at home. He has a brother in a leper hospital in Norway.

Case 62. This man, a Norwegian, is still living, aged forty-four years. His is the tubercular form of the disease. It is said to have first made its appearance in 1893, seven years after his coming to America. In 1899 the question of returning this patient to Norway was under consideration, but the opportunity was allowed to pass, and he is now blind and helpless—a pauper. A leprosarium is the

place for him. He is now a county charge. He has never been married.

Case 63. This man, from Sweden, is still living, aged forty-four. His is the mixed form of leprosy. The disease is said to have been first noticed in 1893, eleven years after he came to America. He was a laboring man as long as he was able to work, but now is a pauper. He has not been married. His mother, one brother and one sister died of leprosy in Sweden. Undoubtedly the place for this man is in a leprosarium.

Case 64. This man, a Norwegian, is still living, aged fifty-five years. His is the anæsthetic form of the disease, and is quite mild. Probably only his physicians and intimate friends know that he is a leper. The disease is said to have first appeared in 1893, eight years after his having come to America. So far as known his general surroundings are good, and he is comfortable at home. His wife and three children show no symptoms of leprosy.

Case 65. This man, a Norwegian is still living, aged about thirty-two. His is the mixed form of the disease. He states that the disease first appeared in 1898 (this is questionable). He has the leonine countenance, but by one not a close observer would not be thought of as a leper. He is able to attend to business. His wife and two children, aged six and three years, show no signs of leprosy. He came to America in 1888. His mother and one sister died of leprosy in Norway. He says his condition is improving under "Christian Science" treatment, but appearances when I last saw him did not bear him out.

Case 66. This man, a Norwegian, died at the age of seventy-three, in 1899. His was the anæsthetic form of the disease. It is said to have appeared twenty-two years before his death, and one year after landing in America (not probable). He admitted having had one leprous cousin. He was a pauper for years, and finally died at the county poor farm. He was not married so far as known.

Case 67. This man, a Norwegian, died at the age of forty-two years, in 1898. His was the tubercular form of the disease. The disease was first recognized in 1876, when he was twenty years old. He came to America in 1877, but, finding no improvement, he returned to Norway about 1880. I think he was in a leper hospital in Norway. He was self-supporting while in Minnesota. He was single.

Case 68. This man, a Norwegian, is still living. He has but recently been reported to the Minnesota State Board of Health, and there has not been time to investigate the case. From the description given, this is the tubercular type of the disease. The neighbors are afraid of this man, and shun him as one unclean.

Case 69. This man, a Norwegian, is still living. His is the tubercular form of the disease. He is a laborer, thirty-one years old, and single. He came to America about seven years ago, and then had leprosy in its early stages. Probably he will become a public charge as he grows worse and becomes unable to work.

Case 70. This man, a Norwegian, may possibly be in our records without designation. He was a brother of Case 32, and died in 1895. I can find no facts on file relative to the case. The father of these two cases also died of leprosy, and is probably one of the early cases on our records without a name. (Case A.)

Case 71. This man, a Norwegian, came to Minnesota, a leper, about 1890. He was then about twenty years old. His trip here was to see if his condition would not improve in this climate. There being no apparent improvement, he returned to Norway about 1897. His was not a marked case of leprosy. While resident in this country he was self-supporting. It is not known positively that he is dead.

Case 72. This man, a Norwegian, is still living, at the age of twenty-two. His is the tubercular form of the disease. The symptoms of leprosy are said to have appeared about five years ago, six years after his coming to America. He is single and destitute and cared for as a public charge, at an annual cost of $650. He lives in a part of the country where the people are unnecessarily alarmed over a leper, and for this reason he has to be given special care. This patient should certainly be in a leprosarium.

Case 73. This man, a Norwegian, is still living, and a *prisoner* for the remainder of his life, which will probably not be long. His is the tubercular form of the disease. He was born in 1847, and came to America in 1882. His case was first diagnosticated as leprosy in 1893. Soon after this it became known in his neighborhood that he was leprous, and the process of ostracising him and his family began. He lived on a farm, and was prosperous. It became necessary for the county commissioners to separate him from his family, and to place him in a house alone, although on his own place, with another leper, less advanced with the disease, to care for him. The community follow out the Bible injunction to the limit in treating this man and his family as unclean. The house in which he lives is about a quarter of a mile from the house in which his family lives. His wife cooks for him and his attendant, and the food is carried and placed at a safe distance from their prison three times a day. It costs the county in which he lives about $600 per annum to care for him. His wife and six children ranging in age from ten to twenty-two years, although perfectly healthy and entirely separated from the patient,

are practically ostracised. When it was found that the children had a legal right to attend school, they and two families related to them were allowed full ownership of the school building, and the school directors set about building another schoolhouse for the rest of the children of the district. I am happy in the fact that this kind of treatment is not as a rule given to lepers or their families in Minnesota.

Case 74. This man, from Sweden, is the keeper of Case 73. He has the tubercular form of the disease. He is poor, is single, and will be a charge upon the county so long as he lives, unless there is some other provision made, state or national, for the care of lepers. His cost is estimated at $600 per annum. He has been resident in the state four years, and has been in the United States seven years. He admits having noticed swelling of the face in 1897.

Case 74*a*. This case is interesting because *not* leprous. He was reported to me as an American-born leper. Investigation revealed the following: A child, fourteen years old, was born in the state where he now resides, of healthy Norwegian parents. He has eight brothers and sisters living, all healthy. When about one year old he had "cholera morbus," but no physician was in attendance. He apparently recovered from this, and learned to walk a little, but later the gait became irregular, and the power of walking was lost entirely in 1890. Paralysis of the lower extremities became complete. At present the chest, shoulders, head, etc., are well developed, but the lower extremities are small. The thighs are flexed on abdomen and to the left, so that, as the child lies on his back, his knees rest on the bed at his left side. The skin is very fair. The boy seems bright, and has a good face. The parents try to take good care of him, but are not as cleanly as they should be. Where the body comes in contact with the bed there is a line of dirt upon the skin and a scaly eruption—a filth eczema. There are eruptions on various parts of the body, due to contact of a sensitive skin with soiled bedding, or to bites. There are also bed sores. It was worth the hard drive that I made of about one hundred miles one Sunday to see this case to be able to say *not leprous*, and that I had yet to learn of the first American-born leper in this section of the country.

Case 75. This woman's history, and the fact that she was well cared for during her latter days, is set forth in the records of the Johns Hopkins Hospital. The necessity for leprosaria is well demonstrated by the treatment this patient would have received but for the hospital already named. She was an American who contracted the disease (tubercular form) in the West Indies. She died in 1900. She was a public charge for three years. No children living.

Case 76. This woman, an American, has been a leper for forty years. She is now seventy-eight years old. Hers was at first of the anæsthetic form, but is becoming more and more tubercular in character. She has been a public charge for eight years, at a cost of $1,000 per annum. She would be a proper case for a well organized leprosarium. I do not know whether she has had children.

Case 77. This man, from Sweden, died at the age of forty years, this year (1900). His was of the mixed type of the disease. It first appeared in 1888. He was a public charge for ten years before his death. He was never married.

Case 78. This man, an American, contracted the disease in Brazil, and died at the age of forty-four years this year (1900). He returned to Pittsburg in 1879, and the disease has a history dating from 1882. His was the mixed form of the disease. He was a public charge for four years prior to his death, at a cost of $1,200 per annum. He was married, but none of his relatives are leprous.

Case 79. A Chinaman died in 1897. He had been a public charge for seven years.

Case 80. A Chinaman died in ——. His was tubercular leprosy. He was a public charge for several years.

Case 81. A Chinese laundryman was found to be leprous. He was placed in a county hospital, where he died eventually.

Case 82. Of this case I have no data.

THE UNOFFICIAL LIST OF LEPERS.

Case 1. This man, a Mexican, was recognized as a leper. He was self-supporting, and when people became suspicious as to the nature of his disease he disappeared. His was the tubercular form of the disease.

Case 2. An American physician, who had been a good deal of a traveler, contracted the disease abroad, and died in this country in a hospital. The final illness was of short duration.

Case 3. A Chinaman, discovered to be leprous, was advised to move on. He did so. It is stated that he wanted to return to China, and he was given means to do so. It is not known whether he followed his inclination in this matter or not.

Case 4. A Greek; when found to be leprous, he returned to his own country.

Case 5. A typically leprous Norwegian woman. When she learned that she was to be examined for leprosy she disappeared.

Case 6. A Norwegian is spoken of as returninng to his native country in 1891 to enter a leper hospital.

Case 7. A Norwegian resident who is classed among the "cured" lepers. His name and residence are known only by his physician, who is pledeged to secerecy.

Case 8. A Norwegian, who lived in a district where lepers were shunned with a vengeance. When his disease was recognized, he was supplied with money and sent, with his family, to Norway. The house in which he lived (not an expensive one, I presume), was bought by the neighbors and burned to the ground.

Cases 9 to 21, inclusive. These are all Icelanders. None of them are known to be leprous in the communities where they live. None of them are American born. In some the disease is said to be "arrested."

Case 22. This was a Chinaman in a neighborhood where there had already been a great deal of trouble over leprosy. When his condition was recognized he disappeared from the locality, but probably not from the state. (See Case E.)

Case 23. This is a Norwegian woman, whose name ought to be in the official list of one of the states, but is not. She is probably dead, for in 1889, she is described as being fifty-eight years old, and affected with tubercular leprosy.

Case 24. This man, a Norwegian, ought to be upon the official list, but his name was secured October 15th, a date too late to allow of further investigation.

Case 25. This man, a Norwegian, had the mixed form of leprosy. He died about 1888. He was kept in a private house, having certain rooms given up to him exclusively. He was a single man. Not a public charge.

SPECIAL CLASS.

Case A. This man, a Norwegian, was one of the early lepers in Minnesota, and died many years ago. There is no positive record of this case, but it is probable that he represents one of the three first in the Minnesota list (Case 10, 11 or 12). He came from a leprous district in Norway. Two of his sons died in Minnesota of leprosy (Cases 32 and 70).

Case B. This man, a Norwegian, died of leprosy about 1884. None of the records on file are known positively to refer to him, but in this, as in the preceding case, it is probable that he represents one of the first three in the Minnesota list (Case 10, 11 or 12). Quite recently I was asked to investigate the descendants of this man, for some of them were suspected as being leprous; but the suspicion was groundlesss. He has children and grandchildren living, none of whom show any signs of leprosy. Tuberculosis has brought death to many of his

descendants, and the conditions of some of these tuberculous patients had suggested to the suspicious the possibility of leprosy.

Cases C and D. Nothing is known of these cases further than that they came from Canada, and were about to settle in Northern Minnesota when they learned that they were to be examined as to their being lepers. Thereupon they returned to Canada. It is quite possible that these were Icelanders, for there as many such in Manitoba, and leprosy is not an uncommon disease among them.

Case E. A Chinaman presented himself to a physician for an opinion as to whether he was leprous or not. He stated that an opinion had been given in the affirmative. He was requested to call at the physician's office for an examination, but never did so. As this occurred in the state where Case 22 was given money and told to clear out, it is quite possible that the two are one and the same.

STATISTICS FROM OTHER PARTS OF THE UNITED STATES.

Leprosy statistics from other parts of the United States may be of interest at this point. Dr. Morrow, in his article in the "Twentieth Century Practice of Medicine," Vol. XVIII, (1899), reports as follows:

For California, a total of 196, at present 26; South Carolina, a total of 16; Texas, a total of 34; Louisiana, a total of 277, at present 131.

Dr. Hyde, to the Congress of American Physicians and Surgeons (1894), reported for other states the total as follows:

Arkansas, 3; Dakota, 2; Florida, 6; Georgia, 1; Idaho, 1; Illinois, 13; Indiana, 2; Iowa, 20; Maryland, 4; Massachusetts, 5; Minnesota, 120; Missouri, 2; Mississippi, 2; New York, 100; New Jersey, 1; Oregon, 3; Pennsylvania, 6; Utah, 3; Wisconsin, 20.

My own records for certain states compared with Dr. Hyde's are as follows:

North Dakota	2	2
South Dakota	...	1
Iowa	20	3
Minnesota	120	61
New Jersey	1	1
Ohio	...	1
Pennsylvania	6	6
Wisconsin	20	7

I presume Dr. Hyde's figures for Iowa and Wisconsin are estimated. Probably they are not too high. I have taken only those cases of which a history could be given. It is probable that the 120 cases credited to Minnesota are taken from Dr. Hansen's report. It seems to me this, too, must be an estimate. Dr. C. Gronvold was in close touch with Dr. Hansen when he visited Minnesota. If there

were 120 cases in the state, I cannot understand why they are not on our records. If there were that many cases in 1888, the number for Minnesota is much higher than I have given, for many of the cases in our official list cannot have possibly belonged to Dr. Hansen's 120.

Dr. Morrow's article (already referred to) states that the Tracadie (New Brunswick) lazaretto has admitted altogether 150 lepers, and that in 1899 there were still twenty-three inmates. He also assigns eleven as a total for Cape Breton and ten for British Columbia.

Mexico has her proportion of lepers.

It might appear from the report of cases in the Northwest that leprosy was far more common in Minnesota than in the neighboring states. I can see no reason for this belief, however, for the lepers in this district are among the immigrants from Norway, Sweden, Iceland and China. These people have quite a representation in all the states of this group. I can only attribute the more complete returns for Minnesota to the fact (1) that there has been less agitation against leprosy in this than in some of the neighboring states; (2) that with this lack of agitation against leprosy physicians report their cases more willingly to the state board of health, which has endeavored during the last twenty years to palliate the sufferings of this unfortunate class; (3) that Minnesota is fortunate in having among its physicians men who are familiar with leprosy, and who are interested in philanthropic work, and these physicians have given material aid to the state authorities engaged in securing a list of all lepers in Minnesota. It may be worthy of note that several lepers in the Minnesota list give the history of a previous residence in Wisconsin, but their names in not a single instance appear upon the Wisconsin records. It might seem to some that, in discussing the leprosy question, it was only necessary to consider those cases now living; but if we are to judge of future needs we must know conditions of the past as well as of the present. Of the thirty-seven living lepers known to be resident in the Northwest, permit me to state that seventeen only are in Minnesota, and there is a strong possibility of two of these being dead, but we have no positive knowledge of the fact.

It does not seem that all parts of the country are favored as are Minnesota and adjoining states, where not a single American-born leper is to be found, even among the descendants from a leprous parent.

I do not dwell upon these facts as an alarmist, but simply to remind you that leprosy has existed, does exist, and will continue to exist for years to come in all three countries represented in this Association.

Were we to look only at the disease and its future it might be dismissed without further consideration by the group of Northwestern States especially referred to in this report. But we must admit that imported cases will continue to appear, even here, and humanity demands that such should be cared for rather than to allow them to drag through years of suffering.

With this presentation of facts I think all will admit the need of leprosaria, and most of you, I doubt not, will feel that the nation is better fitted than any one state to establish and maintain them. It is impossible for a single state, even though it may have a considerable number of lepers, to provide for them at a reasonable rate or to make them comfortable. Louisiana is the only state that has tried to establish a leper colony. In many states lepers are cared for as paupers, but they cannot be allowed to associate with other paupers; hence, they are cared for in "isolation wards," which are, as a rule, veritable prisons, and often a hell on earth.

The uninfected have an inherited dread of leprosy. They do not appreciate that tuberculosis, syphilis and many other preventable diseases are far more dangerous than is leprosy. Hence comes the unreasonable persecution of the leper. If a laborer, he is no longer able to secure employment. If an individual living in comparative comfort, the cry goes out through his neighborhood, "Unclean! Unclean!" and in consequence his neighbors shun, not only the leper himself, but all those who are associated with him. His family is ostracised. His children are either excluded from school or their surroundings are made so uncomfortable that they by choice prefer to stay away. I have seen a family, with children ranging in age from ten to twenty-two years, which was practically shut out from the world because, forsooth, the father was a leper. He did not live with the family, nor have any intercourse with it, and yet the ostracism was complete against all its members.

With a husband depending upon his work at a trade to support his family, and who could not get employment because of his wife's illness; with children approaching school age, who were practically shut out of school on account of the mother's condition, I have seen a poor woman pray for death to come and release her and them; and yet she lived for years under just such suffering.

I have knowledge of a single man, by no means a source of danger, who was driven out of the community in which he lived. He had means sufficient to supply his wants. The people with whom he lived knew how to care for him properly, and were willing to do so. He was blind, yet public sentiment drove him away, and made him homeless. A state refused to allow him to travel through it by rail,

and a car containing this unfortunate man was sidetracked. It is hard to imagine what might have become of him had not a good Samaritan, a physician, gone after him, and driven with him a hundred miles or more across country to his own home, where he kept him until he was able to find a safe and somewhat permanent retreat for him. Truly a leprosarium of the right kind would be a blessing to all lepers subjected to such indignities. It is not only the leper who is financially poor who demands our thoughtful care.

I have seen leper colonies that were nothing but places of abode for the living dead. Far be it from me to urge the establishment of such places in our country. Let us consider briefly what we should find in a leprosarium, and then decide whether we are to work for the establishment of our ideals.

A leprosarium should afford a comfortable home for lepers. This means, not only good buildings, but extensive grounds comprising many acres, where the lepers may have liberties and still be in exclusion. The buildings connected with the leprosarium must combine the privileges of a home and of a hospital. Those who have the disease in mild form may need little if any medical care. They need comfortable clothing and good food. With those in whom the disease is more advanced, the care should be that of a hospital patient, with medicines to lessen their sufferings and dressings that would commend themselves to any surgeon.

A leprosarium should resemble our modern colonies for epileptics. It should furnish employment for those who are able to work, and amusement of various kinds for all.

The patients ordinarily found in hospitals stay in them for possibly a few weeks, and then return to home and friends. Not so with the leper. He is an outcast,—a patient for life,—but not necessarily confined to bed except for brief periods.

In establishing leprosaria we must give some thought to the lepers and their disease. It would not be humane to transport those who by inheritance and birth belong in a tropical climate to a leprosarium in Minnesota, while on the other hand people of Scandinavian or Icelandic origin should not be sent to Louisiana or the Hawaiian Islands. It would seem, therefore, that at least two leprosaria were needed in the United States. The time is ripe for taking hold of this matter. The committee of which I as chairman present this paper was created by this Association two years ago because the need of such humane action was recognized as a necessity. The replies to the circular letter which I sent out, tabulated on page two of this paper, seem to show that sanitarians generally recognize both the need of leprosaria and the fact that they should be national rather

than state institutions. California has already memorialized congress in favor of the national care of lepers. Louisiana, I doubt not, would be glad to transfer her lepers from their present place of abode to a national leprosarium such as I have presented in outline.

Two of the strongest medical societies in Minnesota have placed themselves on record as favoring the establishment of national leprosaria. The American Dermatological Association has a committee appointed, to determine, if possible, the best methods to be used in the care of lepers. It would seem that this Association should be ready to place itself on record as anxious to find some solution for this vexed proposition. One thing is certain: we will have lepers in this country for years to come, whether imported or of our own production. The thing for us to do is to recognize the fact, and meet it. The questions involved are those of sanitation and humanity. Sanitarians are, as a rule, humanitarians, and, as we are a recognized body of sanitarians, it is time to act. I, therefore, in closing this paper, propose the following resolutions:

WHEREAS, It is a known fact that lepers are found in Canada, the United States and Mexico; that these lepers represent immigrants of many nationalities, together with some Americans; that the exclusion of leprous immigrants by inspection is impossible; that the tendency to importation of leprous immigrants in the future will be greater even than in the past; that the danger of infection of American residents abroad and the importation of the disease through these channels is greatly increased; therefore be it

Resolved, That this Association place itself on record as favorable to the establishment of national leprosaria, which may serve, not only as a refuge for lepers, but also as a home and hospital, making their lives tolerable so far as possible, furnishing employment to those who are able to work, and giving skilled medical care to all cases, with the intent of possibly curing some, and making the road to death less wearisome and painful than it now is to others.

REPORT OF COMMITTEE ON ANIMAL DISEASES AND ANIMAL FOOD.

By D. E. SALMON, D. V. M., Chairman, Washington, D. C.

Your committee to which has been referred the important subject of animal diseases and animal food has given much attention to the developments of the year in this direction, but only finds it desirable to invite the attention of this Association to a very few topics.

GLANDERS.

It has come to the notice of your committee that during the last two years there have been in some localities an unusual number of cases of glanders in horses. This increase has been observed in widely separated States and over a considerable extent of territory. As glanders is a disease easily communicated and fatal to man, these observations are of especial interest to this Association, particularly in these days when serum from horses is so largely used in the treatment of human diseases. The more prevalent is this disease, the greater should be the care exercised in the selection of horses for the production of serum. It is, therefore, more important at this day to eradicate glanders than ever before. We have not only the danger of accidental infection to those who come in actual contact with the affected horses, but we have in view the very desirable object of maintaining the reputation of our horses for healthfulness since they have become the source of remedial agents of world-wide use.

It has been the experience of all countries that glanders increases in army horses during the progress of a war. The necessities of military operations often require the hurried collection of horses, the omission of the usual precautions against contagion, the most severe physical exertions and the sustenance of the animals upon minimum rations,—conditions which favor the introduction and propagation of the glanders contagion.

The short war with Spain was no exception to the rule and the army horses became extensively infected, carrying the contagion after the conclusion of hostilities to various parts of the country. Whether this method of dissemination accounts for the entire increase in the disease, your committee has not the means of ascertaining, but it is worthy of remark in this connection that the United States Army appears to be the only one among civilized nations which does not have an organized and commissioned veterinary service to guard the health of its animals. The veterinarians at present are employed as

civilians, they are distributed among the cavalry regiments with no bond of union. There is no professional head to the service to make regulations; to hold the regimental veterinarians responsible for intelligent action, and to instruct them as to their action in the case of emergencies. There need be no surprise, therefore, that when we have even a short war disease, and especially glanders, becomes epizootic and develops beyond control.

RABIES.

There has come to the attention of your committee during the year information which demonstrates the frequency of rabies in the United States, and which indicates that the disease is becoming more common. This result is not entirely unexpected when we consider the increase in the canine population of the country and the fact that measures of control are but seldom adopted, being at best of temporary application and lacking in thoroughness.

In an outbreak of rabies at Buffalo, N. Y., the Health Department carefully investigated 95 cases of furious rabies in dogs and 35 cases of dumb rabies. Many other cases occurred which were not investigated. Four persons were victims of this outbreak. In the District of Columbia there has also been a serious outbreak of this disease. During the year ending June 30, 1900, 45 cases in dogs, 4 in cattle, 1 in the cat, and 1 in the horse. In each of these cases the nature of the disease was demonstrated by inoculation experiments made by the Bureau of Animal Industry. That bureau has also made observations in previous years, and has demonstrated by inoculation experiments the following cases in dogs: 1893, 11; 1895, 2; 1896, 5; 1897, 3; 1898, 7; 1899, January 1, to June 30, 4. Other outbreaks have been reported to your committee from Maryland, New Jersey, Pennsylvania and Minnesota, all with positive evidence of the character of the disease. Information of similar outbreaks in several other States has been received, but your committee has not had an opportunity to investigate and establish their character by incontrovertible evidence. While about twenty persons were bitten in the District of Columbia during the year nearly or quite all of them took the Pasteur treatment and no deaths have occurred. From various parts of the country have been received accounts of disease and death of numerous domesticated animals of different species with the symptoms of rabies. Some of these have been investigated, notably the death of 18 cows at the Governmental Hospital for the Insane in the District of Columbia, and the diagnosis confirmed by inoculation experiments.

Fatal as is the disease in man, and your committee is of the opinion that no single case has been known to have recovered; agonizing and

terrible beyond description as are the sufferings of the human patient, your committee finds its greatest cause for alarm not in the dreadful nature of the disease, nor yet in the difficulties attending its control by sanitary measures, but in the existence in the United States of numerous societies with large membership which are deliberate and active in the circulation of literature calculated to deceive the people as to the existence of this disease and to develop obstacles and resistance to the health officers in their efforts to eradicate it. So marked has been the effect of this literature even at the Capital of this advanced and intelligent country, with all its education and science, that the order for muzzling dogs during the outbreak could not be enforced, and all regulations for the control of the outbreak were finally abandoned.

It is most unfortunate that some members of the medical profession have joined in this crusade to discredit the results of the experimental studies of this disease—scientific studies which began with the century and are still being continued. Their sincerity and honesty is not questioned, but surely where there is so much at stake for the human race, and where it is so easy to repeat the crucial experiments upon which our science rests, these gentlemen owe it to their own reputations and, above all, they owe it to their profession to make a careful investigation before distributing broadcast to the laity their misleading and deceptive statements. One of these gentlemen advertised in a newspaper of the city of Washington offering a reward of $100 for a case of rabies in man or animal. The chairman of your committee offered to produce a case at any time if the diagnosis were left to a committee to be appointed by the Medical Society of the District of Columbia, the money, in case it was earned, to go to a charitable society. This proposition has never been accepted. Another gentleman has publicly stated that he has sought for a case of rabies for sixteen years without being able to find one, and yet in his own city, at the Veterinary Department of the University of Pennsylvania, there have been numerous cases nearly every year, characteristic and well authenticated, which he could have seen and investigated by merely asking permission. It has been frequently asserted that there has not been a single well-established case of either rabies or hydrophobia in the great city of New York for the past thirty years, and yet the records of the American Veterinary College show an average of seven cases a year for twenty-five years, and the bacteriologist of the Department of Health of that city has, during the last three years, confirmed the diagnosis of rabies in forty cases in domestic animals and in three cases in mankind.

This is a country governed by the people, and health officers cannot go far beyond the sentiment of their constituency without meeting with the most serious checks and reverses. If the people know the facts there should be no difficulty in stamping out such a dangerous and dreaded contagion; but in a community prejudiced by misleading statements, inflamed by assurances that there is no danger and that the measures adopted are relics of barbarism forced upon the citizens by ignorant and unscrupulous health officers—in such a community it is difficult or impossible for the sanitarian to afford relief.

Your committee is firm in the belief that some means should be devised of educating the public upon this subject. The agencies of misinformation are numerous and far reaching; not only are there special journals maintained by the societies referred to, but open letters have been sent to the editors of all newspapers asking them to suppress accounts of this disease and furnishing them literature by which to convince their readers of its non-existence. It is not too much to expect that the members of this Association will in their several spheres be active in the dissemination of truth and in combating the plausible and deceptive fallacies to which reference has been made.

TUBERCULOSIS.

Your committee finds in the tuberculosis of animals a disease of transcendent interest, not only because of its effect in lessening the food supply, but because of its deleterious influence upon food products and the possibility of the contagion being transmitted to man and causing fatal results. Seven years ago in discussing this subject your committee advised conservative and moderate action with a view of gaining time for educational work, and allowing dairymen an opportunity of gradually reducing the disease in order to avoid burdensome losses.

The developments of the intervening time have not been as satisfactory as we had reason to expect. In some States the authorities were too radical and harsh in their proceedings and the result has been practical stoppage and failure of their efforts. In other States there has been a ceaseless agitation against and denunciation of the tuberculin test, the only effectual means of discovering the disease in living animals. Every argument has been used to make the efforts of those who were trying to eradicate the disease appear to be unreasonable, unnecessary and an uncalled for persecution of the cattle owners. Not only have these agitators insisted upon the right to furnish the public with dairy products from tuberculous animals, but they have cultivated the sentiment that tuberculosis is not a bad thing to have in a herd. The situation as it exists today is one of

the most vivid examples that we could have of the difficulty of protecting human health and human life where we have on the one side the considerations of commercial gain and personal aggrandizement, and on the other the claims of humanity.

In a few States good work is being done and the disease is being diminished. In most States there is either no effort being made to repress the disease, or such effort is too feeble to have any appreciable effect beyond the irritation of the cattle owners. In the meantime it has become apparent that swine are affected to an extent which is calculated to bring disquiet to those who know that with these animals the disease is usually acute and often generalized. As swine are generally fed the skim milk and buttermilk, it is to be expected that tuberculosis will increase with them in the same proportion that it does with cattle. The changes in dairy methods which has led to the establishment of creameries has probably contributed to the dissemination of tuberculosis among swine. If, for example, there is only one tuberculous herd of cows in a community the infectious milk of that herd would be mixed at the creamery with the milk of all the other patrons of the establishment, and would thus infect the whole. The skim milk and buttermilk afterwards divided and returned to the several farms might infect every herd of swine in that community. This danger might be counteracted by sterilizing the waste products before they are allowed to leave the creamery, but this precaution is usually neglected.

Your committee has carefully considered the arguments of those who oppose action for the control of tuberculosis, and asks your indulgence while some brief references are made to them. The one assertion which includes all others, is that bovine tuberculosis is not communicable to man and hence the sanitarian is not warranted in causing animals so affected to be removed from dairy herds. If this contention were demonstrated, would the conclusion necessarily follow? Evidently not. Consider, if you please, a herd like that belonging to Her Majesty the Queen, and which furnished milk for use at Windsor—and there are many such herds, and not all of them in Great Britain. This herd was under veterinary supervision and was believed to be healthy, yet when tested with tuberculin ninety per cent. were found tuberculous, and upon post-mortem examination some of them revealed most extensive lesions. Is it conceivable that a cow will give normal and wholesome milk when it has a whole lung transformed into a tuberculous mass, with tubercles disseminated through the liver and other organs, and with, perhaps, tuberculosis of the milk ducts as well? Would anyone knowing the animal's condition be willing to drink the milk from such a cow or give it as food to

his children, even if satisfied that the specific disease tuberculosis could not be transmitted in that manner?

It appears important that the milk supply should come from healthy cows, and that any animal having extensive inflammation of any kind, in any organ, and particularly any disease accompanied by extensive suppuration or mixed infection should be condemned as a milk producer. It is claimed, however, that many cows which react to tuberculin and would be destroyed have comparatively small lesions and such as would not affect the quality of the milk. This may be granted as an undoubted fact; but, on the other hand, it is equally certain that almost as great a number with serious and extensive disease are discovered with tuberculin and could not be discovered in any other manner; it is also certain that a majority of those with minor lesions will in time become badly affected, and that no one can tell the day or the hour when their milk assumes a dangerous character.

Having said this of the disease without reference to its contagious character, your attention is invited to the principal arguments of those who insist that bovine tuberculosis is not communicable to man. It is scarcely necessary to remind this Association that bovine tuberculosis is caused by the bacillus tuberculosis; that this bacillus is frequently found in the milk of tuberculous cows; that the milk of such cows has been inoculated upon guinea pigs and rabbits and produced tuberculosis; that the milk of such cows has been fed to guinea pigs, rabbits, swine and calves and produced tuberculosis. So much for the well known experimental evidence.

The conclusion which would seem to follow from this evidence that the milk of tuberculous cows is dangerous to the human consumer has been met, and the attempt has been made to counteract it by certain experimental evidence and certain conclusions which are worthy of a critical examination. Firstly, it has been asserted that the tubercle bacillus is only found in the milk of cows with tuberculous udders, or in that from cows in a very advanced stage of tuberculosis, and that in either case the diseased animals may be readily discovered by physical examination. This assertion has been made by men who stand high as authorities, but the evidence upon which it is based is far from satisfactory.

A short time ago the Bureau of Animal Industry tested a herd of 102 cows belonging to a Government institution in the District of Columbia. Seventy-nine of these animals reacted, and as more than fifty of them were in good condition without physical signs of tuberculosis in the udder or elsewhere, it was considered a favorable opportunity to test the infectiousness of the milk. The test to which

reference will now be made was conducted by feeding the milk to guinea pigs, The final results have not yet been reached, but a large proportion of these cows, over twenty-five per cent., gave milk which killed guinea pigs with tuberculosis in a very few weeks. Dr. Ravenel has been associated with similar experimentation in Pennsylvania with an even larger number of cows, 14 per cent. of which gave infectious milk. Considering the number of cows experimented with, and the large percentage which produced infectious milk, the results cannot be passed by as exceptional, and, consequently, we can no longer accept the statement that there must be plain disease of the udder or evident emaciation before the milk becomes infectious.

In the very instructive observations and experiments made by Dr. Theobald Smith of this Association, it has been shown that there are certain morphological peculiarities and cultural characteristics which prove that the tubercle bacillus from human sputum and that from bovine tuberculosis differ considerably, and when inoculated the human bacillus is less virulent for cattle and for some other animals. These results have been confirmed and must be accepted as a valuable contribution to our knowledge of this important subject.

These facts have been taken up by those who oppose the work for the eradication of bovine tuberculosis and conclusions drawn from them far beyond what the investigators have ever claimed. It has been defiantly asserted for example that because the human sputum bacillus has but slight virulence for cattle and can with difficulty only, if at all, be made to produce extensive lesions with these animals, that it necessarily follows that the bovine bacillus is harmless to mankind. It must be evident to any pathologist that this reasoning is fallacious, but nevertheless it has had an enormous influence in shaping public opinion and in deciding legislative action in some parts of the country.

It may possibly be found that it is not safe to accept the sputum bacillus as an accurate measure of the virulence of human tuberculosis, and when the bacillus from early tubercular lesions in man is compared with the sputum bacillus there may be found important differences. But whether this turns out to be the case or not the fact that the sputum bacillus does not readily multiply in cattle is no evidence that the bovine bacillus will not readily multiply in the human body. It is not an uncommon phenomenon that a microbe loses virulence when passed through certain species of animals and gains virulence when passed through others. Thus Pasteur found that the virus of rabies was attenuated in the bodies of monkeys; but no one would claim because rabies virus from monkeys is not virulent for dogs that conversely rabies virus from dogs is not virulent for monkeys.

Again we have in cowpox and smallpox either two closely allied diseases, or, as many claim, two varieties of the same disease. Smallpox is very virulent in the human subject and easily communicated from man to man, but strangely enough it is only inoculated with some difficulty to cattle, and is then localized and produces only a mild form of disease, with a tendency to attenuation if passed from animal to animal. How far from the truth would we be if we concluded from this fact that because smallpox virus does not retain its virulence in cattle, cowpox would not be communicable to mankind. That cowpox is easily transmitted to man and that it is reproduced with all its characters and activity is shown by every successful vaccination.

A study of the facts of comparative pathology, therefore, does not warrant the conclusion that because the sputum bacillus is not virulent for cattle, the bovine bacillus is not virulent for man. It would be more in accordance with analogy to reason that the tubercle bacillus develops a higher virulence in cattle than in man, and that it is not only more virulent for cattle but for man also. It has been already shown that the bovine bacillus is not only more virulent for cattle than is the sputum bacillus, but it is more virulent for guinea pigs, rabbits, swine, dogs, cats, sheep and goats. Now there is a general rule in comparative pathology that a contagion which is virulent for several widely separated or unrelated species of animals is virulent also for mankind. The contagion of anthrax, rabies, epizootic, aphtha, glanders, maliginant œdema, tetanus and cowpox are striking examples. If this rule were applied we should be forced to conclude that the bovine bacillus is dangerous to man as well as to these various species of animals.

Coming to facts of more direct application and we have the evidence of accidental inoculations of man with the bovine bacillus, which may be contrasted with the anatomical tubercle caused by similar inoculations with the human bacillus. A comparison of the recorded cases of such inoculations which we have been able to find in a cursory search of the literature indicates that the effects in man produced by the bovine bacillus have been at least as serious as those produced by the human bacillus. A member of this committee, Dr. Ravenel, has put on record three cases of inoculation of man with the bovine bacillus. Pfeiffer relates a fatal case in which the contagion was contracted in this way: Veterinarian Moses, who came of a healthy family, wounded himself in the left thumb while making an autopsy of a tuberculous cow. The wound healed without suppuration, although the knife probably penetrated the joint. After six months, however, there developed on the scar a cutaneous tubercle with dis-

ease of the joint. In about a year from the inoculation symptoms of tuberculosis of the lungs developed ending in death six months later.

Your committee does not consider it desirable on this occasion to enter into further details in the discussion of this subject. It has presented the matter as comprehensively as is possible in a brief report, and it holds that the recent investigations not only do not weaken the older evidence as to the danger of bovine tuberculosis to human health, but that on the contrary they strengthen that evidence and make its application no less certain. All of which is respectfully submitted.

INVESTIGATION OF STREAM POLLUTION BY THE UNITED STATES GEOLOGICAL SURVEY.

By F. H. NEWELL, Hydrographer, U. S. G. S.

By what is known as the organic law of 1879, creating the office of Director of the U. S. Geological Survey, it has been enacted that: "This officer shall have the classification of the public lands and examination of the geologic structure, mineral resources, and products of the national domain." By further legislation this term "national domain" has been interpreted to mean all of the land included within the boundaries of the United States and its outlying possessions. The "mineral resources," has also been taken to include the water supply, and by specific appropriation acts the Geological Survey has been empowered to gage the streams and determine the water supply of the United States, including the investigation of underground currents and artesian wells.

In order to most effectively execute the provisions of the law regarding the water resources of the country a special division or branch of the Geological Survey has been organized,—known as the Division of Hydrography. Its duties are to ascertain the amount of water flowing in various important rivers in different parts of the country; to survey natural reservoir sites; prepare estimates of the cost of water conservation; examine the geologic conditions which govern the occurrence of water underground, and prepare maps showing by appropriate symbols the depth at which water can probably be had in various localities. The sum of approximately $100,000 per year is expended in this work. In the examination of resources of water for power, irrigation or industrial purposes, the question of first importance has been the quantity and its fluctuations. The quality of the water has entered less into consideration, because of the fact that most of the streams examined have been in the newer or more remote and thinly-settled portions of the country, where the streams coming from mountain catchment areas are to a large extent free from artificial impurities. In the case of a few rivers, however, especially those receiving water from "Bad Lands," or unconsolidated or easily eroded strata, the question of amount of sediment carried has been of great importance, and steps have been taken to determine the sediment in suspension, and the rate of deposition under various circumstances.

The progress of the hydrographic surveys has been as a rule from the vacant public lands of the West toward the populous regions of

the East. This has arisen from the fact that the more pressing problems were those connected with the disposal of the public lands and the introduction of irrigation. Later, the questions of undeveloped water power, especially in the Appalachian area, have assumed great industrial importance, and as these are being systematically disposed of the demand has arisen for similar measurements in streams where industries have become well established. In connection with these latter rivers, it has been found that it is not sufficient to determine merely the quantity of water and its fluctuations year by year, but more than this, we must know something of the quality of the water, especially as modified by the presence of a larger population.

In the systematic work of the Division of Hydrography a suitable point is found upon a river where observations of height of water can be made continuously, or daily, throughout a year or a series of years. This record of daily height of water is interpreted into quantity of flow by means of occasional measurements of discharge made by suitable devices,—usually electrically recording current meters. These tables of daily flow afford an opportunity of studying the regimen of the stream and of knowing the time and occurrence of high and low water. The relation between the estimated rainfall and outflow from a given area can also be had, and many of the other data upon which are based engineering studies of the value of the stream for power or other purposes. These observations are carried on for a number of seasons sufficiently long to afford a knowledge of the range in volume through successive years. It is hoped to maintain measurements continuously at a few points in the United States for an indefinite time, in order to include the cycle of wet and dry years which are known to occur at irregular intervals. On most of the rivers the observations extend throughout only three to five years.

At certain seasons, while measurements are being made of a stream at a designated point, a careful reconnoissance is had of the drainage basin, in order to obtain facts as to the source of water, the relative importance of various tributaries, the use of the water and the development of industries dependent upon it. At the same time information is had concerning municipal supplies, and careful notes taken of sources of pollution. It has not been found practical to make sanitary analyses of the water, but for the purpose in mind, it is sufficient to state clearly the character of the pollution, its origin and relative quantity. That is to say, it is considered sufficient to state that on a certain tributary there are seven tanneries of a given capacity, three saw-mills of a noted size, and numerous sewers flowing from towns or cities with an enumerated population; also to add that these are discharging into a stream carrying a measured volume of

water. It is recognized, of course, that an analysis of samples of this water would give additional and valuable information, but for descriptive purposes, and especially with reference to the expense involved, it is considered sufficient to obtain these geographic or physical facts, although the biological data would be of great value in a complete understanding of the situation.

Such a reconnoissance as that above noted has been made of the Potomac river above the city of Washington, and the number of manufacturing establishments discharging refuse into the river has been enumerated,—also the sewers of notable size draining many villages and cities. Similar work has been or is being carried on for other parts of the United States, and it is hoped ultimately to cover the country with a systematic examination bringing out the larger facts. Coöperation is sought in this work with all other agencies, such as State boards of health or biological departments of various universities, so that work which otherwise might be disconnected can be cemented into a concrete whole. This work is progressing satisfactorily, but it is desired to have its progress more widely known, in order that a still larger coöperation can be had with other workers along the lines of water supply or water analysis. The Division of Hydrography is willing and able to do what might be called the geographical work of exploring, measuring and mapping, while the various laboratories scattered throughout the country can more economically handle the samples of water obtained at various localities.

The results of this systematic study of the resources of the country are published in two or more series; the first series is that contained in the annual reports of the Geological Survey. These annual reports consist of six or seven large volumes, of which Volume IV, is devoted to hydrography. For example, the results of the work during 1897 are published in Part IV, of the 19th Annual Report; those for 1898, in Part IV, of the 20th Annual Report; those for 1899, in Part IV, of the 21st Annual Report now in press. The second series of publications is known as the Water Supply and Irrigation Papers of the U. S. Geological Survey. These are pamphlets limited to 100 pages, and treating of various matters—such as pumping water for irrigation and other purposes, sewage irrigation, underground waters, tests of pumps, etc. In this series are published also the results of work at the various river stations, giving all of the fundamental data upon which are founded the conclusions embodied in the annual reports. Besides these two series, additional information is contained in the Geologic Atlas Folios, such for example as that of the vicinity of Pueblo, Colorado, where is shown a map giving for approximately

1,000 square miles, the depth of the water-bearing horizon, and the facts as to whether the water, when penetrated by deep drilling, will rise to the surface.

During the past ten years there has been a great awakening to the possibilities of the further utilization of the water resources of the country, and the importance of these, not only for industrial development but in all matters of public health. Engineers and sanitarians are bringing to public attention the importance of conserving and guarding the sources of municipal supply, and as a consequence citizens and municipal authorities are inquiring into matters which before had been neglected. There is thus an ever-increasing correspondence regarding water and its occurrence, both on the surface and underground; and it is the object of the Geological Survey to be prepared as far as possible to answer the more important questions,—those having to do with the broadest welfare of the public. These records and results are at all times open for inspection; and, on the other hand, suggestions and criticisms tending to improve this work are welcome.

OUR DOMAIN'S MOST THREATENING DANGER.

By CLEOPHAS MONJEAU, H. E., Middletown, Ohio.

This time I come as delegate of the American Water Works Association to ask your co-operation in devising ways and means of reaching the people, and through the people their public servants, for laws and other necessary means whereby due relief can be obtained.

Our domain's most threatening danger, as seems clearly to appear from careful observation, is filth. Shocking as this statement may seem, it points to a fact, unmistakable, and to be met.

One of the most dangerous expressions of that threatening danger is found in our unnatural, unscientific, wasteful, yet general practice of dumping and sewering into the waters we drink.

But what does nature answer to these two now most important and pressing questions:

I. How can naturally pure, wholesome water be obtained and conserved?

II. How shall waste be safely and duly disposed of?

The first of these questions appears to be a very old one, and to have been effectively answered not less than five thousand years ago.

Permit me to read you a page from a chapter of a book not yet published as evidence in point. Not being a lawyer, and yet needing a summary of the law relating to pollution of waters of lakes and streams, I asked the most eminent practitioner in the litigation of water rights known to me on either continent, to write me such summary. Here it is, written by Rome G. Brown, attorney-at-law, of Minneapolis, Minnesota:

"The laws which govern most of our personal and property rights have shown changes, sometimes very radical, from the laws of earlier times. But it is an interesting and significant fact that even the latest decisions of American courts affirming judgments against offenders who have polluted streams or lakes are based upon certain general principles of law which have always made such acts of pollution both private and public wrongs in the civil and penal codes of all nations and which have remained unchanged from the earliest forms of written law known in history to the present time. These principles, and the law which arose from them, can be read today in the manuscripts which, written in hieroglyphics and pictured in crude outline drawings, were buried with the Egyptian princes who lived,

fought and died upon the banks of the Nile thousands of years before the migration of the founder of Israel into the land of the Pharaohs. To these ancient worshippers of nature the waters of the Nile and of all tributaries were a divine gift for the use and comfort of man. An individual might own the banks upon the shore and might have certain rights by virtue of his ownership; but the flowing water sent down the streams by the God of the Nile no man could appropriate, divert, or pollute without committing an offense which not only subjected him to punishment under the civil code, but made him subject to condemnation when Osiris, the God of the lower world, should pass judgment upon his soul. And in the negative confession which the departed soul made in the judgment hall of the lower world before the forty-two judges of the dead, no protestation was more repeated nor more emphasized than the one above quoted, which was addressed to the one judge whose sole duty it was to determine whether the deceased had at any time in his life committed the grievous sin of polluting the natural waters of the earth. Carved upon the inner and outer walls of the ancient temple, pictured upon the halls of the dead, the mummy cases, and in manuscripts, is found everywhere in the literature of that people the law against the pollution of the waters which nature had provided for man's use, and which, in order that man should be protected in the uses for which they were intended, must be kept pure and undefiled. The modern law against the pollution of waters is founded upon these early established principles of the law of waters: (1) That they are nature's gift; (2) that they are given, not for appropriation and ownership, but for the use and comfort of man; (3) that man's right is that only of a usufruct; (4) that in order to protect that use, any pollution must be forbidden."

"The same ideas are expressed in the Lord's reproof of the shepherds, which is found in Ezekiel, showing that the ancient Hebrews recognized the same principles of law against the pollution of waters." (See Ezekiel, xxxiv, 18 and 19.)

You probably are aware that it was the firm conviction of the famed Egyptian and Greek archæologist, Professor Lepsius, that these same principles of the "law of waters," and the politico-religious doctrine of keeping sources of water supply sacredly pure, was more or less completely inherited from the Egyptians and the Hebrews by the ancient Greeks, then by Etruria from Greece, then by the Romans from Etruria, and from Rome by England, etc.

Naturally pure, wholesome water for vegetation *is not such for animal life*, but exactly the reverse. Therefore, water which may cause vegetal life to thrive at its best may, and often does, sicken or

kill animal life, while quite often waters are found which improve animal health, but fail to energize and duly feed vegetation.

Naturally pure, wholesome water for animal life is that prepared in nature's way, and much as blood is for our bodies. For example: The salty sea is relative waste, from which water is to be redeemed, re-energized and requalified for the healthful use of aerial animals by re-evaporating, recoming in contact with air by refalling on the earth, where it naturally qualifies for the thrifty support of animal life by first naturally effecting natural exchange with vegetation by percolation through more or less life-full soil clad with vegetation. In this way redeemed water is rid by nature of the vegetal cells which it inevitably gathers in its intimate ministrations to all organic life, and is made mete for wholesome animal use and stored in the streams or veins of Mother Earth for that special purpose, and there naturally and fully protected by naturally inevitable vegetal growths. Thus nature makes natural purification of water *inevitable*, at the same time and by the same means that it makes the natural pollution of water *impracticable*. So works omniscient Omnipotence, and so are the two realms of nature's component opposites duly provided with this fundamental and constantly active medium of life-force—suitable water.

II. How shall waste be safely and duly disposed of?

For the purpose in hand, waste may be defined as creatures denied further existence in a living organism, because of oppositeness of inhering nature. But in no instance can waste from a living organism imply dead matter, because like produces like, while death, at most, can only be life reversed, so to speak, or inverted. In other words, the life-force which has constructed an organism whose existence is quenched, is thereby reversed and set to dissolving or fining back to atoms the body which it has constructed, and to thus liberate said life and enable it to return to life's infinite source.

Water is a most potent friend. It is an equally fierce foe. It has cut the Alps and all our mountains from crest to base in order that it may bless its intelligent users along its life-full courses. No power on earth ever stopped water. None could. None can. It seems as if the mate of Omnipotence. Hence selfish and filthy nations have been, are still, and must ever be cut down and off the earth by their criminal abuse of this most useful element. Unquestionably this is in accord with divine wisdom, and for the highest good of mankind—to teach men, doubtless, due regard for one another's rights, those of their Maker, and, possibly, to hint forth the majesty to which He bids all life through schooling by nature.

The ancient Latins, it seems, had a just and natural understanding of what animal waste really is, as their exactly accurate word—excreation—evidently reveals. Every excretion is, in truth, an ex-creation, or re-creation by a creation, as all nature is there to show. Hence, it must, in the nature of things, be a living being. And such it undoubtedly is, as the diseases it generates conclusively prove.

The fact is established that every pore of the living body is a living individual creature in a combination or community, or communities, of individual creatures composing a larger individual, and so on. Hence, every excretion of every pore of a body must be a living individuality. This is precisely what science is gradually detecting.

As every creature, individually, as by kind and variety, has its office and duty in life instinctively assigned, every pore and group of pores, as every member and group of members in a body, has its assigned office and purpose. The office of animal pores here fixing our attention is that of excreting matter no longer having the qualities required by the animal body, because of its being virtually exhausted of power to further serve such body, and, consequently, being already reverted and prepared to nutritiously feed vegetal life instead, and hence being more or less poisonous to animal life, is released.

This seems briefly and clearly to explain how and why it is absolutely necessary for animal and vegetal life to be constantly exchanging excretions, and, at the same time, it tends to reveal in some degree the inconceivably great economic power and foresight of nature, whose every provision seems safeguarded by infallibly inhering laws with self-executing penalties. Hence it is that the sewering of animal and other waste into the waters we drink does and *must* result in disease, death or debility, and, consequently, prove a crime against nature, nations and the neighbor. Therefore, such sewering clearly is a wrong to estop.

Nature has so protected herself and sway that such unnatural sewering must set at war against each other the most beneficent components of water for each of her realms, namely, the cells naturally belonging to naturally pure, wholesome water for animals, and the vegetal cells naturally constituting reverted food or waste, which is only matter refused by animal life because suited exclusively for vegetal growths. These different species of bacteria or germ cells, when brought together by means of waste in water, largely destroy one another. This is practically proven in many ways, but in none more clearly than in the disinfecting of water by means of artificial filtration, the least ineffective of which is that which halts the largest number of these cells into a film where they reduce one another into

a neutralized, semi-glutinous substance through which it becomes difficult for any but very minute bacteria or spores to pass. Thus it happens that one of the most effective disinfectants or means of removing harmful germs from waste-polluted water proves, at the same time, the most effective in "sterilizing" or making such water incompetent for its naturally assigned offices. This discovery, it is now found, happens to have been incidentally attested in advance by no less an authority than Surgeon-General Sternberg, in his Lomb Prize Essay on Disinfection, etc., in which, on page 13, he says:

"The experimental data on record indicate that those agents which are efficient for the destruction of any one of the pathogenic organisms upon which experiments have been made, or of harmless species of the same class,—e. g., the bacteria of putrefaction,—are efficient for the reduction of all, *in the absence* of spores. There is, it is true, within certain limits, a difference in the resisting power of different organisms of this class to chemical agents. This is not, however, sufficiently marked to prevent the general statement that *a disinfectant for one is a disinfectant for all, in the absence of spores.*"

This is a concise, clear recognition of the woefully significant fact that the artificial agent or agents used to destroy given species of living cells in polluted water destroys all—harmful and helpful alike.

"*Antiseptics and deodorants* are useful when it is impracticable to remove offensive organic material from the vicinity of human habitations, but they are a poor substitute for cleanliness."

But what is so-called "purifying" of water by any artificial means, if it is not disinfection—an effort to prevent epidemics—the spread of disease as fire spreads?

In the very nature of things, there is no substitute for natural cleanliness, nor can be.

The daily experience of our three constituent countries, as of the world throughout history, unquestionably is that no sterilized creature can perform all natural offices inheringly assigned it, and that in proportion as a body is mutilated its naturally destined efficiency is reduced or destroyed. And exactly so it is with with water mutilated by any means and to any extent.

Here again naturally arises this important question:

How shall waste be safely and duly disposed of?

1. Certainly not in the waters we drink, and for all the reasons already stated, and many more.

2. Waste in such water, as is everywhere recognized and fully proven, causes disease, death and incalculable suffering, sorrow and loss.

3. It appears impracticable to justly estimate the mortality in our domain caused by the effects of sewering waste into the water we drink, at less than 300,000 souls each year. In other words, Mr. President, as facts are there to show, such unnatural disposal of waste as our famously intelligent countries are still guilty of—costs North America more lives and suffering than have all the wars from the siege of Jerusalem to the fall of Peking!

4. The fact is plain that animal waste is poisonous and repellant to its producer and animals of other species in proportion to their proximity of likeness to the creature excreting, a condition which reverses only at the line of demarkation between the animal and the vegetal realms.

5. It should be remembered that there is no dead matter, as Professor Kohler taught us and the scientific world years ago. In other words, both the great kingdoms of nature consist of living active and living passive beings. Hence the animal and vegetal kingdoms, both consisting of living creatures, appear to have been designed and destined to intimately correspond and exchange products in every way and sphere of existence by means of the blood and body of Mother Earth. Hence, also, vegetal creatures are fixed in the soil and globe, while animals are locomotive, and each realm is absolutely dependent on the other for healthful continuance in being, wherein each must wait on and serve the other.

6. Throughout both her vast and clearly expressed realms of throbbing forms, nature iterates and reiterates in billions upon billions of infinitely varied thoughts willed forth in life-urged dust—the stern, immutable fact that waste must be returned to the soil in such way that vegetal life can freely absorb it as its naturally destined and choicest food, and, therefore, from *within the soil.*

7. Certain it is that Moses, who received his education at the most enlightened court of ancient times, proved himself a master in hygiene, as of human nature, for, in forty years of the most arduous and difficult campaigns of record, while almost incessantly in the midst of field operations on a scale far exceeding anything else ever tried on tented fields, and with millions of women and children to care for, apparently did not suffer as much discomfort and death from the effects of filth-diseases as did the United States Army during forty weeks of the Spanish-American war. Evidently, the secret of Moses' incomparable achievement was his close knowledge of, and intimate contact with, nature and its author. For example:

8. In Deuteronomy, Chapter 23, verses 13 and 14, he appears as commanded of Jehovah to inform his people how to safely and duly dispose of waste, and plainly directs that it be disposed of *in the soil.*

And the foremost law-giver of all known ages thus states the reason why this must be: "For the Lord thy God walketh in the midst of thy camp, to deliver thee, and to give up thine enemies before thee; therefore shall thy camp be holy: that He see no unclean thing in thee, and turn away from thee." In other words, such disposal of waste is "holy"—worthy of the service of nature and its God—or worthy of employ in the worship of Him who devised and fashioned nature as we find it.

It thus appears that we cannot continue to dispose of waste contrary to what nature exacts (as every state and province of our domain is now doing), without first reversing the seemingly eternally established order of being. Meanwhile we must pay the cost of an hopeless experiment in wasted life and strength and homes and incalculable sickness and increasing debility and want, until the only end possible to such practice comes to our beloved lands, as it has repeatedly to other great and mighty peoples who persisted in heedlessness of nature's immutable claims unto utter extinction, or we radically reverse our course.

It is a most significant fact that there scarcely is a city of any considerable age or size in all our vast domain which has not already changed its intake or its source of water supply from two to six times in efforts to abate or avoid the destructive and deadly effects of our general practice of sewering into the waters we drink, namely, disease and death. Still our population, as a careful estimate reveals, is not yet one percentum of what we can liberally house and support. Already, however, every stream is, in fact, practically a trunk sewer, and every lake a besewaged pool. For example, the sewage poured into the Mississippi River and its tributaries steadily forms about one-half of their respective bulk. In many of our streams little more than sewage flows during much of summer, while most the beds are filling with sewage sediment at a rate to alarm all thoughtful observers.

At such a rate of abuse of water sources, where are our children to find drinking water, and what are succeeding generations going to do for this necessity of life, unless we halt and reverse our course? How can we expect this globe to continue to live in healthful condition with its veins full of putrefying waste? How could any one of us expect to exist with his blood treated in such way? It seems certain enough that if we lived at all, it could only be to rot alive. How else can it be with Mother Earth, in whose being man lives and dies an integral, indivisible part? We already have a faint foretaste in a loss each year of some 300,000 lives by reason of such filth, besides one and a half million cases of sickness and recovery, and all the

suffering and waste of time and treasure which that implies. Meantime, as every duly informed man knows, "purifying" does not purify, since it can but destroy, as already shown.

At the same time, the sewering of all this natural refuse to the seas, if persisted in, can only prove a slow means of suicide for this naturally most favored section of the globe.

But another item of vital import here needs statement in order to afford a fair glimpse at this matter of highest concern.

As any competent observer can learn by study of the thrifty old parts of Christendom, natural waste is of more intrinsic value than gold. It is a country's most handy and abiding means of resource. Hence, our destructive disposal of this natural base of permanent wealth has already so impoverished our soil that our yearly bill of cost for artificial fertilizers amounts to nearly one hundred million dollars for this country alone. What is this, if it be not a robbing of future generations at the same time that we criminally sewer our apportioned wealth in soil to the seas? Already New England has some four thousand farms utterly depleted and abandoned. Much of the older portion of Canada is but little, if any, better off; while Mexico could considerably improve most of her old tilled soil. Even our richest valleys alarmingly show the effects of this general depletion. For example, but about one acre in a thousand still yields crops two-thirds of its average annual product during the first four years of its tillage. Our Southern States have millions upon millions of acres of formerly rich plantation lands that are now "growing wild." The occasion of it all is plain. Like any other servant of man, the living soil must be fed if made to labor and produce, and natural waste appears its unalterably assigned food.

All told, it seems to clearly appear that North America's annual loss, in life and treasure and time and natural increase and wealth and interest, etc., by reason of our unnatural and yet general means of waste disposal, sums up about two billion dollars per year; whereas, with her unsurpassed, if anywhere equalled opportunities and resources, she should close each year with a net gain of fully one billion dollars.

Mr. President, and Fellow Americans: Are these conditions to which we, the sons of as noble, brave, just and self-sacrificing sires as ever trod this earth, should silently submit? Do not our very professions and consequent duties to the people forbid? Are we not all, under our Supreme Sovereign, the framers and finishers of our destinies? Do we owe nothing to rising and future generations? Is there any just right which our countrymen can fail to perceive and

protect? I cannot so believe! Therefore, I am convinced that never has Almighty God said more plainly to men than he now says to us:

"Dwellers in as favored lands as grace this globe: housed by streams of your first mother's liquid life, as you prize life and its noblest ends,—as you rate good and cherish right,—as you value true wealth, and such homes as are castles of freemen and shrines of holy knowledge—cleanse your sources of the waters of life and keep them clean, for as are the waters ye drink, so are ye. Care for waste as you do for life, and of soil as kindred flesh, for it equally holds in trust the bread, raiment and needed wealth of all generations to the last."

PAGES FROM A SANITARIAN'S NOTE BOOK.

By WILLIAM S. DISBROW, M. D.,

Chairman Sanitary Committee, Board of Health, Newark, N. J.

It has been stated that while Newton sat quietly smoking under a tree in his garden, the second of the immortal apples fell, and he began to think. If I may be permitted, I wish to offer you the result of my thinking upon sanitary affairs,—having the same smoky origin.

My experience in sanitary matters is, that but few comprehend the value of measures promulgated for their good, if it necessitates the use of their property, the unloosening of their purse strings, or that which puts them to any inconvenience; but how appreciate of its good, and how gladly do they make known to us their discovery of the fact that their neighbor's closet has the impunity to be odorous, while their own is as free from taint as the breath of the first born.

A study of the strange fact of immunity, or that species of acclimation, which a tenant is supposed to possess—how thankful he should be that he, unlike any other known animal, is able to oxygenize his blood without oxygen, but with sewer gas; while his rich landlord finds it necessary to reside in the mountains or seashore to secure his air sifted and re-oxydizied by pine-tree or wave.

Did you ever suffer from a bad attack of the injunctions? If not, see how we got it, and where. Our board had for a long time desired a sterilizing plant, and all the preparations were made for its establishment. Boards of health propose, but the councils dispose. The following reads like some proclamation from the dark ages, and you will hardly believe that it is a production of this enlightened period:

LET EVERY MAN OF THE
NINTH WARD
ATTEND THE MEETING OF THE
BOARD OF HEALTH,
IN THE COUNCIL CHAMBER,
WEDNESDAY EVENING, NOVEMBER 18TH, NEXT,
AT 8 O'CLOCK,
TO PROTEST AGAINST PLACING A
DISINFECTING STATION
IN OUR WARD.
COME YOURSELF AND BRING YOUR NEIGHBORS
WITH YOU.

The dodger quoted was distributed throughout our city besides being mailed to those in the ward mentioned. They received their

injunction in spite of all our efforts, as not only one ward was the offender, but all equally as bigoted. What a commentary! What a disgrace! Here let me state that we have just secured legislation, which will enable us yet to bring this class of people to the realization, that by right they should be allowed to die in their sin; yet, though they are asleep, science is wide awake—ready to return good for evil, and to save them in the expectation that they may reform.

The medical profession, generally, is in accord with our work, and the greatest appreciation is felt for them in their unselfish assistance; but there is one variety with which we come in contact, which is lower than the amœba—a thing of slime, unorganized and unevolved—a blight to the profession to which he is legally affiliated.

It is he who would undermine the fair temple of the healing art, by ignoring the laws of health in his contact with his patient, hiding from us infectious diseases that he might profit by the probability of an increase of infected homes.

His sneer is more deadly than war, and his warped, atrophied brain is the producer of thoughts, which are conveyed to others, receptive only because of the lack of that knowledge which he is supposed to possess as a physician. How he is persecuted when he is brought to bar! How he pleads—how child-like in his simplicity! Push back his hair and you will find the horny growth, which is the mark of his paternity. If you have a law for this kind of an offender, especially if there is a heavy fine attached to it, "hit" him, and "hit" him as hard as you can, for unless you touch his gold, your ordinances will be ineffective.

The bacterial control test, as used during disinfection, we have found to be, aside from its great sanitary value, a great developer of the character in the men of our Disinfecting Corps. Why is it that one man's work reveals so many positives, while another's continually displays the peculiarity of an obstinacy on the part of the "bug" to die? This we find can be positively rectified by the prompt dismissal of the tender-hearted employe, and the substitution of one who is more cold-blooded and careful.

The common use of water gas in our cities calls for some action on our part, not only from the standpoint of poor quality of our light, but from the increased danger it offers through poisoning by carbon monoxide.

Its great diffusing properties enable it to escape through defective piping; permits house and soil saturation to the great detriment of public health. Time and time again a note of warning has been raised in protest against gas companies mixing water gas with illuminating gas—the product of coal alone. Its convenience and well-

known deadly qualities have made it a popular means of suicide. Aside from this, I am certain that many mild and indefinite cases of water-gas poisoning exist, which are attributed to other causes.

The composition of boards of health is a curious study. That which I have in mind will answer for illustration, as I think it can be duplicated in some respect by many of you.

This Board, by a strange coincidence, had three tanners as Commissioners, and you can imagine what a glorious time its health officer had of it, proving to them that the offal from a tannery stank, or how anyone could object to the well-known perfume of their works, or the sachet-like refuse, which they scatter so freely—away from their own homes. Another was fond of chickens, and he could never be persuaded but that others enjoyed the early crowing of the cock and the happy morning devotions of his family. If a citizen was annoyed by them, he was too sensitive; or in the case of one who was connected with a large chemical concern, his acid fumes were too mild to eat up his neighbor's linen, or to irritate his eyes. It was a mistake; all foolishness; they did not make that kind of a fume; his nitric was warranted to be as unctuous as a political promise.

The most damning and withering cause of the impotency of boards of health is the "political member." It is he that stays the carrying on of successful sanitary measures; it is he who would desolate the home-circle and upturn the sod of the graveyard, rather than he should lose a vote from his partisans. A full ballot-box is an argument more potent than sanitary measures—disease, tears and death make no impression upon his ganoid body—no feeling enters his septic soul.

Our boards of health must be free from the leash of the party-leader, and the leprous taint of this spoilsman must not enter the abode of Hygeia, for, if so, every ambition and scientific interest will be blighted by this curse of our sanitary bodies.

What we want in our sanitary affairs, is the best men obtainable, and when we get them we want them to remain as free acting beings, who will stand, if they have to stand, alone, breasting the waves of opposition which surge against them; free from the politician, whose pocket is full of horse-chestnuts for rheumatism; asafœtida for cholera; a camphor bag around his neck to down any other kind of a germ, which he thinks is looking around for him. But as bacteria, obeying the laws of other animate things, live on something, it would die from inanition upon the nourishment derived from this infernal nuisance.

We should know the great value of human life; should be as watchful of our death rate, as in the collecting of our taxes; should see to the sanitation of our cities before their beautifying; we should do all in our power to establish a wholesome respect for matters pertaining to health by the people, and, particularly, those in authority, in the enforcement of sanitary regulations; but I am afraid that when this shall have occurred, the ilustration of the lion lying down with the lamb will be mild, compared with the municipality, who placing its finances on one pan of the scale—health on the other, without bearing hard on the money end.

The judiciary must understand the importance of our work, for to them we must go for assistance in the drawing and passing of measures of such help to us in our labors.

It is he who must show us the difference between knowingly and willfully poisoning a neighbor with the foul emanations of a drain or closet, or poisoning him with the more elegant cyanide pharmacal preparations used in the more elite circles of society.

It must not be supposed that it is only the lower class of our people who are the most ignorant, and the source of our troubles in sanitation. Not at all, for without being disrespectful to anyone's religious principles or belief, I desire to call attention to a case of diphtheria in a home of riches, intelligence and culture. The child was dying; all that medical science could do was unavailing; the clergy were offering prayer and devotion to Him, who while upon earth was a physician, but with no result. The parents broken-hearted—a dear one taken away.

In the cellar for a long time was a broken sewer pipe, whose deadly emanations had more than a local reputation; whose breath was like the face of Medusa, death-dealing to all who drew near; but whose power could have been destroyed forever by the expenditure of the few paltry dollars, which the loving parent would not spend.

The quotation that "The Lord giveth and the Lord taketh away," is but partly correct. No greater libel on the Almighty has ever been uttered than that, when there is attributed to Him the removal of dear ones under such circumstances. It was ignorance, not Providence.

The city well is a source of great annoyance. Its cold, pellucid water, with a record for wholesomeness, which all science cannot destroy. Its owner comes with a record of having drank it from boyhood, and all his pedigree before him. He calmly remarks that: "If all we state is correct, why are they alive and well?" Little does he think that nature had been trying for several generations to produce one man not a fool in that family. Everything comes to him

that waits—so my friend get on your knees and thank God that the typhoid germ has not made your acquaintance before, for it will surely do so the first opportunity that presents itself. Then you will find that with three or four weeks' tussle with typhoid, if you are fortunate enough to live,—during your convalescence you will have time to enjoy your luck and to get into a more receptive condition to consider your reformation, as a drinker of your neighbor's discarded bacillus typhosus, and close your fountain of perpetual youth.

What shall we do with the abominable habit of the exposure of food stuffs, by our grocers and butchers? Is there any other way which is more certain to give results undesirable and needless? The dust, with its load of bacteria from our streets, finds a secure resting place upon the stacks of edibles piled high and broad upon their stalls. The handling by the public, which is one of the worst features of this condition of things, and as we know what a complex mass is represented by that word, what is to prevent the syphilitic and tubercular from choosing their food with the rest of us. May not the mucous patch compete with the tubercle, with results equally disastrous? Should not some method be devised to protect us from these several nuisances with satisfaction to the tradesman, as well as to his patrons.

The uncertainty in the minds of the people, and our neglect to enlighten them in regard to bacteria is criminal. The majority of the public imagine that whenever this name is mentioned, that it is suggestive only of disease and death; and it never occurs to them that of all sanitarians, they are the most indefatigable in their work, and certain in their results; not for evil, but for good. We should carefully explain in our reports, particularly those made on water supplies, that though they be apparently numerous, yet all of them may have a character above reproach, and none may represent those productive of danger.

It is likely that a pathogenic germ dreads more than anything else a man in perfect physical condition, and if a comparison of mutual feelings was made, the germ would come out second, and, perhaps, the lesions produced in the body, after its unwilling entrance, are but the marks of his struggle for his own existence and not the individual's.

I doubt very much that a bacterium ever maliciously crawled into a man. It is probably as much of an accident in one case as another, and these so-called accidents are what we want to investigate as sanitarians; but let us in justice free the public's mind of the idea that they were only introduced to annoy; and only then when we

make special inducements by converting one body into an environment suitable to their growth.

We are accused of wanting too much, and that our suggestions are impracticable; but I hardly think that when it is understood that our motives are altruistic and not personal; that all we want is the people to vie with us in our endeavors to protect them from disease. We want them to not only reach the classic three-score years and ten—we want it to be a disgrace to die at all.

A RÉSUMÉ OF THE RECENT FOREIGN WORK OF THE MARINE-HOSPITAL SERVICE.

By DR. R. M. WOODWARD,

Surgeon Marine Hospital Service.

The acquisition of new territory by the United States during the past few years has brought with it many new and important duties, not the least of which is the protection of our country against the invasion of epidemic disease from these possessions, and the protection of the possessions themselves against such invasion from the outside. Congress has placed these duties upon the Marine-Hospital Service in each case where action has thus far been taken, and this brief paper is for the purpose of presenting an outline of the recent foreign work of the service.

At some of the ports in question a very good system of quarantine was found, but it is believed that, with the advent of modern disinfecting machinery and the institution of new methods of inspection and disinfection, these safeguards can be increased in efficiency.

No one doubts the advisability of checking a disease upon a foreign shore before it is given an opportunity to reach the ports of the United States. So long as epidemic disease is prevented from being carried across the sea, the general public feels much more at ease than when the same appears, at more or less frequent intervals, at the quarantine stations on our coasts. The value of the services of officers stationed at foreign ports is not to be estimated alone by the actual quarantine work which they perform, but also by the sanitary reports which they transmit to the bureau, keeping this country thoroughly posted as to the progress of epidemic disease in foreign countries. All of our new possessions and dependencies have cable communication with the United States, except Hawaii, and it is to be hoped that but a short time will elapse before this is established. With the execption of a few isolated regions, an outbreak of epidemic disease in any part of the world can be known in Washington within twenty-four hours after its occurrence.

In past years one of the greatest dangers to the health of the United States has been the city of Habana, where smallpox has prevailed almost continuously and where yellow fever has occurred in epidemic form each season. A medical officer of the Marine-Hospital Service has been stationed at Habana for a number of years, mainly for the purpose of issuing bills of health to vessels bound to the

United States and for submitting sanitary reports concerning the health of Habana and its vicinity.

When Cuba came under the protection of the United States, the coast of the island was divided into five divisions for maritime quarantine purposes, each division being under command of a commissioned officer of the Marine-Hospital Service, located at the principal ports thereof, namely: Habana, Mantanzas, Nuevitas, Santiago and Cienfuegos. At each of the smaller ports, acting assistant surgeons were appointed under the general supervision of the division officers. Twenty-six officers of the latter grade are now on duty in Cuba.

The disinfecting barge "Protector" was sent to Habana in March, 1899, and did good service as a floating disinfecting plant. It was anchored in the harbor and was fully equipped with disinfecting machinery, consisting of steam chambers, sulphur furnace, bichloride pump, formaldehyde apparatus, bathing facilities, etc. The "Protector" has been returned to the United States and its place taken by the "Sanator," a disinfecting steamer of larger dimensions, being probably the most complete floating disinfecting plant in the world. The officers of the service on duty at Habana are treating gratuitously the crews of all vessels arriving in the harbor, and this keeps them thoroughly posted on any disease which may appear among the shipping.

All means lessening the amount of yellow fever in Habana diminish the danger to the United States from that port. The outbreak this summer has been largely among newly-arrived immigrants from Spain, who have been in the habit of landing at Habana and remaining in the city for several weeks until they could secure employment on the estates. Governor-General Wood has suggested a plan to lessen this danger, namely: To have the immigrants inspected, as is now the case, by the Marine-Hospital Officers, upon arrival, and then to transfer them immediately to an immigrant detention station which will be constructed near the village of Triscornia, across the harbor from Habana. Here they will be held until distributed to the country districts, without coming in contact with infected foci in the city proper. This station will be controlled by a board of directors, of which the senior Marine-Hospital Officer located in Habana will be a member.

The former Spanish quarantine station at Mariel, about twenty-one miles from Habana, has been transferred to the service, and the buildings have undergone many repairs and improvements. It is located on an isolated neck of land, separated from the country back of it by a stone wall. Eighteen buildings were found on the reservation, well planned and arranged for the purposes of detention and segregation.

This is now one of the most complete plants in existence. A small steamer has been purchased for use at Habana, and for plying between the city and the Mariel station. This is in addition to a launch and tugboat which are in constant use in the harbor.

The hulk of a sailing vessel was purchased, remodeled and equipped as a floating disinfecting plant with all necessary modern disinfecting machinery, and was stationed at Santiago, Cuba, where it has done good service. It has been very aptly named the "Rough Rider." Similar barges are now ready for the ports of Matanzas and Cienfuegos, Cuba, and one will soon be completed for Nuevitas, Cuba. This provides a complete plant for each of the principal ports in the five subdivisions of the coast mentioned above. Vessels at any of the smaller ports, requiring disinfection, can easily be referred to one of the larger ports for treatment.

While giving due credit to the officers, both national and local, at the quarantine stations of the United States, the absence of an epidemic of yellow fever this season must be largely attributed to the work of the officers in Cuba. The details of their system, which have been perfected by long experience, cannot be entered into in the scope of this paper.

With the acquisition of Porto Rico, it became necessary to establish quarantine stations in the island, and an act of congress gave this duty to the Marine-Hospital Service. Prior to congressional action the Surgeon-General brought about the issue of an executive order placing the quarantine in Porto Rico under the Marine-Hospital Service until such time as Congress should make other provision for same. San Juan and Ponce are the principal ports, and are under command of commissioned officers. Nine acting assistant surgeons are stationed at the minor ports of the island.

Miraflores Island, in the harbor of San Juan, was transferred to the service by the military authorities, for the purpose of a quarantine and detention station. It contains twenty-four acres and is well located for the purpose. The Spanish buildings found thereon have been renovated and remodeled, and new buildings are contemplated. A floating disinfecting plant is now completed and will soon be towed to San Juan. The latest model of steam launch has been purchased from the Navy and is in use as a boarding vessel at that port.

The harbor of Ponce is not landlocked, and it is, therefore, impracticable to station a floating plant there. It is, however, contemplated to establish such a plant at the port of Guanica, which is about twenty miles west of Ponce on the southern coast of Porto Rico. This port has a fine harbor, safe in time of storm, and containing sufficient depth of water to permit entry to deep draft vessels, being the point

at which General Miles landed his troops during the Spanish-American war. A small island in the harbor will probably be purchased for locating necessary detention buildings.

Regarding Hawaii, the act of Congress, approved Aprl 30, 1900, placed the Marine-Hospital Service in control of maritime quarantine in the territory, and transferred to that service the quarantine station and grounds on Mauliola Island in the harbor of Honolulu together with all the public property belonging to same. There are twenty-two buildings, large and small, on the reservation which, after some repairs and alterations, are in very fair condition. Steam chambers and some other disinfecting machinery were found at the station and negotiations are now under way for a floating disinfecting plant in the harbor. Pending the arrival of this plant, a sulphur furnace will be installed at Honolulu on the end of a long pier which now exists in the harbor. A Navy launch, similar to the one sent to San Juan, has been purchased and is now in use at that port.

Inspection stations, with acting assistant surgeons in charge, have been established at the ports of Hilo, Kahului and Kihei, respectively.

During the recent outbreak of plague in Honolulu, the Marine-Hospital Bureau sent a large supply of Haffkine's prophylactic and Yersin's serum to the medical officer, who tendered same to the Hawaiian authorities, by whom it was used with good effect. The officer there on duty also acted in an advisory capacity during the epidemic and was of great assistance to the authorities.

In the Philippines, the chief ports are Manila, Iloilo and Cebu. Commissioned officers of the Marine-Hospital Service are on duty at each of these ports. The former Spanish quarantine station at Mariveles, on an arm of Manila Bay, about twenty-eight miles from Manila, has been transferred to the service. Extensive repairs and improvements are now being made, including the construction of a pier. This station will be as complete as the one at Mariel, near Habana. Excellent launches have been purchased for use of the boarding officers at Manila and Iloilo. The traffic by water from the ports of the Philippines and the inter-island traffic in the archipelago is enormous; and with plague, leprosy and smallpox prevailing there at the present time, the services of the officers are invaluable.

In Central America, acting assistant surgeons are stationed at all the fruit ports, throughout the quarantine season, to inspect vessels and issue bills of health in conjunction with the consuls. They hold prospective passengers under observation a sufficient length of time to insure their freedom from infection, and disinfect their baggage.

Their services prevent delay at domestic quarantine stations of vessels carrying perishable cargo.

When plague appeared in Europe, notably at Oporto, and there seemed danger of its introduction into the United States, commissioned officers of the service were stationed at all the principal British and continental ports where emigrants embark for this country, namely. Glasgow, Liverpool, London, Southampton, Queenstown, Bremen, Hamburg, Rotterdam, Antwerp, Havre, Marseilles, Genoa and Naples. They inspected all vessels and passengers leaving for our ports, and disinfected all baggage and cargo requiring such treatment. At the same time they kept the bureau posted regarding epidemic disease in Europe and the far East, in addition to submitting many valuable reports upon public health measures adopted by the different cities and countries, and the methods of conducting various lines of commerce involving sanitary risk. One officer was detailed to visit Oporto during the outbreak of plague at that place, and made an interesting report upon the subject. Another officer investigated the rag industry in Egypt, it having been ascertained that a large portion of the rags collected in that country were shipped directly or indirectly to the United States. With the decline of plague in Europe, the majority of the officers were recalled, but one was detailed at each of the following ports, namely: London, Berlin, Vienna, Paris and Naples, to keep the bureau informed on epidemic and sanitary matters, and also for the purpose of being within easy call in case of emergency. The wisdom of this detail was shown when plague broke out in Glasgow, two officers being immediately sent to that point and two others to Liverpool. With this skeleton organization in Europe, it would be an easy matter to again establish the inspection at all of the principal seaports on a few days' notice.

An officer is now on his way to Hongkong, who will, in addition to other duties, keep the bureau posted regarding the danger which may be involved in the return of troops from the Orient to the United States. The bureau also has a representative at Yokohama and another at Kobe, Japan.

An officer is stationed at Constantinople, who submits valuable information regarding the events of that interesting region, particularly the annual pilgrimages to Mecca.

A representative is at Rio Janeiro, which city is seldom free from some of the quarantinable diseases. One is also stationed at Veracruz, Mexico, a port which is always productive of solicitude on the part of those interested in maritime quarantine. This officer has recently made a tour of inspection of the important parts of Central America and the ports of Colombia and Ecuador in South America,

with reference to the danger of transmission of disease from the infected to the non-infected ports from which vessels sail directly to the United States.

It will thus be seen that the principal points of danger in the world are covered by the service, and, with its corps of 106 commissioned officers and 164 acting assistant surgeons, it is an easy matter to throw a force of men into a dangerous point at any time that the exigency may arise.

The value of the safeguards on this side cannot be overestimated, but the officers at foreign ports form an outpost which can only be fully appreciated by studying the details of their work, which the time at my disposal will not permit me to present.

REPORT OF THE COMMITTEE ON TRANSPORTATION OF DISEASED TISSUES BY MAIL.

Prior to the last meeting of the American Public Health Association in Minneapolis, Dr. G. E. Tyler, Secretary of the State Board of Health of Colorado, had begun proceedings at Washington looking towards the securing of certain changes in the order of the Postmaster General (No. 677, December 27, 1897), relative to the use of the mails for the transportation of pathological specimens and cultures, which were obviously needed.

At the Minneapolis meeting of the Association, Dr. Wesbrook, with whom Dr. Tyler had been in correspondence concerning the proposed changes, moved that the former committee of the American Public Health Association be re-established with Dr. Henry Mitchell, the retiring President of the Association, as Chairman. Dr. Mitchell, however, appointed the present committee.

The work already begun and almost completed by Dr. Tyler proceeded and before the final announcement of and notification to the committee had been made and action could be taken, Order No. 677 was modified and Order No. 176, dated March 2, 1900, appeared. This order of the Postmaster General did not agree in all points with the changes recommended by the Colorado State Board of Health, and was amended on May 28, 1900.

As Dr. Tyler had already given the work so much thought and had been for some months in correspondence with manufacturers regarding a desirable form of outfit, it was felt by your committee that in consideration of the action already begun and then nearly completed in Washington, it would be well to study thoroughly the Colorado outfit, directions, etc., before proceeding further. Great delay on the part of the manufacturers and others has, however, prevented the distribution of these outfits, directions, specifications, etc., which Dr. Tyler had expressed his willingness to supply to the members of the committee for inspection and criticism.

To some of the members of the committee it seemed desirable that recommendation to the postal authorities should be broad enough to permit of the sending of more than one tube in each mailing case. Particularly is this important in diphtheria diagnostic work, since some laboratories insist on the return by the physician of both swab and culture tube on the ground that if swabs alone be employed, the diphtheria bacilli are occasionally apt to die out before reaching the

laboratory. Furthermore, there is the growing tendency by some boards of health to examine specimens from both nose and throat in cases of suspected diphtheria, under which circumstances it would be much more convenient and preferable to employ but one mailing package to contain all specimens sent from the same patient at the same time.

With these points in view, the matter was submitted to the Section on Bacteriology and Chemistry at the present meeting of the American Public Health Association in Indianapolis. It was the consensus of opinion of the laboratory section that any recommendation made by your committee should be broad enough to permit of the sending of from one to four tubes in one package and that the specification for the form of outfit and method of packing, etc., should be as elastic as is compatible with safety in order not to interfere with the methods of work employed in the operations of health board and other laboratory workers.

Your committee, therefore, at this time, is not prepared to make final recommendations to the postal authorities of the three countries represented in this Association.

(Signed) J. J. Mackenzie.
W. H. Park.
George E. Tyler.
Domingo Orvanaños.
Henry Holton.
F. F. Wesbrook, Chairman.

October 26, 1900.

OFFICIAL REPORT OF THE PROCEEDINGS OF THE TWENTY-EIGHTH ANNUAL MEETING.

Held at Indianapolis, Indiana, October 23, 24, 25 and 26, 1900.

October 23d—First Day—Morning Session.

The Association convened in the Lower Auditorium of the German House, and was called to order at 10 a. m. by the President, Dr. Peter H. Bryce, of Toronto, Ontario.

Captain W. H. Armstrong, Chairman of the Local Committee, tendered the compliments and good wishes of each individual member of the Local Committee. He said that the ladies of Indianapolis, members of the committee, tendered their special greetings to the ladies who were among the visitors.

He then introduced Governor James A. Mount, who delivered an address of welcome.

President Bryce responded briefly to the addresses of welcome in a few well chosen words. He hoped that the influence of the Association would be felt in a way to benefit the city by giving a forward impetus to the good work already so well begun in Indianapolis for the public good.

Captain Armstrong made a report as Chairman of the Local Committee of Arrangements.

The President.—The next thing in order is the reading of the minutes of the last annual meeting.

Dr. Montizambert.—As the minutes extend over one hundred pages of the Transactions of the Association, have been printed, and are in the hands of the members, I move that the reading of them be dispensed with, and that they be considered as approved. Seconded by Dr. Lachapelle, and carried.

Dr. J. Breña, of Zacatecas, Mexico, distributed copies of a printed address by him in which he conveyed the greetings of the Mexican members of the Association.

The President.—The Secretary reminds me that there is a notice of a motion to amend the Constitution.

The Secretary.—The following are the proposed amendments to the Constitution:

To Article IV. After the word Treasurer, add, "and the officers of the various sections."

To Article X. After the word Treasurer, add, "and Chairmen of the various sections."

Add as new Article the following:

Article XVII. Members of the Association may be authorized to form themselves into sections by vote of the Association at any annual meeting; such sections shall have power to nominate their officers to be elected by the Association, and to make by-laws which shall go into effect when approved by the Association. (Offered by Professor Robinson.)

THE PRESIDENT.—What will you do with the proposed amendments to the Constitution?

DR. WILLIAM BAILEY, of Louisville.—I move that they be adopted. Seconded by Professor Robinson, and carried.

THE PRESIDENT.—We will now listen to the report of the Executive Committee by the Secretary.

THE SECRETARY.—The Executive Committee held a meeting yesterday at 10 o'clock, acted upon 53 applications for membership, which it refers to the Association with the recommendation that they be elected. (The list of applicants was read.)

DR. SAMUEL H. DURGIN.—I move that the Secretary be authorized to cast the ballot of the Association for the election to membership of those gentlemen whose names have been read by him. Seconded by Dr. Henry Mitchell, and carried.

The Secretary cast the ballot of the Association, as instructed, and they were declared duly elected.

THE PRESIDENT.—If there is no other new business to come before the Association at this time, we will proceed to the reading of reports and papers.

Dr. J. N. Hurty, of Indianapolis, Indiana, read the "Report of the Committee on Car Sanitation" in the absence of the Chairman, Professor S. H. Woodbridge, of Boston, Massachusetts. (See page 103.)

Dr. Domingo Orvanaños, of Mexico City, Mexico, read a "Supplementary Report on Car Sanitation." (See page 111.)

Before the discussion on these reports was taken up, Dr. E. P. Lachapelle, of Montreal, made the following motion: I move that the report of Professor Woodbridge be printed in pamphlet form and sent to the managers of all railway companies in the United States, Mexico and Canada. Seconded by Dr. Jones, and carried.

DISCUSSION OF THE REPORT OF THE COMMITTEE ON CAR SANITATION.

Dr. J. N. Hurty, of Indianapolis, Ind.—Mr. President: This Association could do good work in sleeping car sanitation if its members would simply demand that the blankets in sleeping cars be white instead of colored. It would be a great reform in sleeping car sanitation, because the white blanket would tell its own story of cleanliness or uncleanliness, while the colored one does not. We know that these colored blankets are not unfrequently saturated with filth; they are not properly cleaned and sterilized. The Pullman Car Company will not make this change until the public is educated to it and demands it. I think if every member of this Association would talk white blankets day in and day out, and insist that they be substituted for colored ones, after a while we would have them.

I have had a great many talks with sleeping car porters, and one of them during a conversation said to me in a laughing way that if he made up a berth and it had not been used, but the linen had become rumpled in any way, the next comer would not occupy the berth. He thought this was ridiculous. We know that the linen is usually clean, while over it there is all too frequently a foul blanket.

Dr. H. M. Bracken, of Minneapolis, Minn.—The letter presented from a railroad official, stating that it was unreasonable to ask certain things of them, is worthy of consideration. The ordinary cars can be easily cleaned. To get what is necessary in this line we must ask many of the railroads to comply with certain regulations; there may be some delay in this as it requires time in which to formulate reasonable regulations. A statement was made in the letter already referred to, that the water ordinarily furnished in railroad cars was as good as that which the traveling public had for home consumption. This is not true of all places. Some of us may live in typhoid infected cities, and may never use at our homes the public water supply. We do not want the railroad companies to fill their car drinking tanks from such impure public water supply. For example: Minneapolis has a public water supply that is not safe for drinking purposes. Many Minneapolitans are very careful when traveling on any car starting from Minneapolis not to drink water from the water tank of such car, for they have every reason to believe that such water is from the impure public supply, which is not safe for anyone to drink.

The question of controlling Pullman cars is one we may well discuss now. These are in fact a luxury. We pay a good price, however, for berths in them and it is no more than right that we should demand good sanitary surroundings.

The point touched upon by Dr. Hurty with regard to blankets is an important one. Unquestionably many of the sleeping car blank-

ets are filthy. A bed is made up at night; a person sleeps in it, in the morning the linen is taken away, while the mattress and blankets are thrown into the upper berth, and there they stay until the next night. It is not at all uncommon for people in entering a Pullman car to complain of the odor of stale bedding. A few days ago I traveled in a sleeper where I was charged $3.50 for the privilege of occupying a berth one night. Unfortunately, I am rather susceptible to certain vermin, and that night was made hideous to me by the vermin present in that sleeper running from Denver to Omaha over the Union Pacific line.

Dr. C. H. Jones, of Baltimore, Md.—I would like to call attention to that class of cases that usually travel long distances. I refer particularly to cases of tuberculosis. It has been my misfortune to travel a long distance with tuberculous patients who wished to die at home. My advice was for them to die away from home. We all know that on account of the feelings of the members of the family, a patient suffering from tuberculosis is brought a distance of one or two thousand miles at great expense and occupies sleeping cars all the way. With all the care and precautions we can take, there are still possibilities of the blankets being spat upon by these patients. The attendant or nurse cannot always be with them to cover their mouths with handkerchiefs. There is a tremendous amount of work to be done in the direction of car sanitation. I should be glad to second any resolution to the effect that railway managers be notified of the great danger to the public, and when the public shall have been properly educated along these lines we will get what we desire, and I do not think it will be very long.

Dr. Samuel H. Durgin, of Boston, Mass.—I had hoped that Dr. Lachapelle's motion might be so amended that a committee, consisting of Drs. Lachapelle, Hurty, and such others as the President might select, might take the recommendations of this report and amend them as their judgment might dictate, and that whatever is sent out to the railroads of the country might be in such form as to appear to the best advantage. I think that would be agreeable to Professor Woodbridge.

The President.—I should suppose that the Committee on Publication, who have the printing of these reports in charge, would consider that as one of their duties, or rather their privilege to so edit the report as to put it in shape best suited for distribution. I hardly think it is necessary to have a resolution on that point.

Dr. C. P. Wilkinson, of New Orleans, La.—The chief objection to the equipment and furnishings in railway cars in this country is

that they are upholstered in absorbable material. In the extreme South that difficulty has been overcome by furnishing the seats of railway cars with rattan and steel springs, doing away with plush or any other absorbent material. These rattan seats are comfortable; they are cool in summer, and warm in winter.

Dr. A. W. Bitting.—I like the report of the committee very much, also the suggestions contained therein. The managers of these railroads are business men, and they look upon communications coming from various committees and associations like this as being written by men who are more or less cranky on these subjects. It occurs to me, that some benefit might be derived by enlisting the ladies in this matter. They are the ones who look after matters of cleanliness. They are associated with these matters at home, and if they could be interested in this matter, I believe much good might be accomplished by them. I simply make this as a suggestion. We can readily understand that no person would care to sleep in a bed that had been previously occupied by a man or woman with some contagious disease.

Dr. U. O. B. Wingate, of Milwaukee, Wis.—I understand that the International Association of Railway Surgeons has been devoting some attention to car sanitation, and it appears to me that it would be well for a committee of this Association to coöperate with that body. It is a large body of medical men, and any suggestions we may have to offer should go to them. I think they would appreciate any suggestions coming from us, and would be glad to carry into effect any recommendations that might come from this Association.

Dr. J. N. Hurty, of Indianapolis, Ind.—I am glad that Dr. Wingate has referred to the work that is being done by the International Association of Railway Surgeons, which held its meeting in Detroit in May last. At that time the subject of car sanitation was taken up and thoroughly discussed. I read a paper in which I embodied pretty nearly all of the ideas that have been advanced in Professor Woodbridge's report, and made a series of suggestions of the character just read, and the Association adopted them almost in their entirety, saying they would recommend them to the managers of the various railroads. So there is progress being made along this line. The International Association of Railway Surgeons is ever ready to back us up on these problems, and the members agreed most heartily with the white blanket idea, as well as removing from the cars all drapery which could possibly be dispensed with.

Before taking my seat, I wish to say, that one railroad is now constructing seven cars with perfectly plain interiors. The bottoms and backs of the seats can be easily taken out (I am referring now to common day coaches) and sterilized at the end of every run. Of course, the various railroads have no control over the Pullman Car Company.

THE PRESIDENT.—The next thing in order is the "Report of the Committee on Steamship and Steamboat Sanitation," by Dr. Frederick Montizambert, of Ottawa, Canada. (See page 54.)

Dr. Montizambert made a brief verbal report as Chairman of this committee.

Dr. Alvah H. Doty, of New York City, New York, contributed a paper entitled, "New Quarantine Methods and Changes which are Called for in Marine Sanitation," which was read by Dr. Henry B. Horlbeck, in the absence of the author. (See page 55.)

Dr. Manuel S. Iglesias, of Veracruz, Mexico, read a paper on "Elements of Defense Against Infectious-Contagious Diseases at the Port of Veracruz." (See page 63.)

DISCUSSION ON THE PAPERS OF DRS. DOTY AND IGLESIAS.

PROFESSOR F. C. ROBINSON, of Brunswick, Maine.—It was not my intention to discuss either of these papers, because I am not as well acquainted with the matters discussed in them as some of the other members of the Association, but in my State we formerly made a great deal of paper from rags, and I was rather surprised to hear from Dr. Doty's paper that there was no particular danger from infectious diseases from cargoes of rags. Of course, we do not incur that danger now as much as we did, because paper is made now almost entirely from wood pulp, but in those days when paper was made from rags, we had several outbreaks of smallpox and of other contagious diseases for which the rags seemed responsible. Usually the cases originated in the dusting rooms. When the bales were opened, and the rags dusted, the dust which came from the rags floated around, and extra precautions were always taken with the employes to keep them vaccinated. It seems to me that bales of rags may carry and distribute infectious diseases.

DR. H. M. BRACKEN, of Minneapolis, Minn.—I was sorry to hear such a statement as that made by Dr. Doty in his paper. To say that a healthy person is not liable to carry the germs of disease in the clothing does not conform with clinical experience. The way some physicians go about amongst infectious diseases, without taking proper precautions, is a disgrace to the medical profession, and

the reading of such a paper as this before this society would tend to countenance such negligence. Many of us can cite instances in which physicians have undoubtedly conveyed the germs of contagious or infectious diseases to healthy people. If we are going to take such a position as has Dr. Doty on this subject, we must do away with a great deal of our school exclusion. According to the views advanced by him, if a member of a family has scarlet fever, we must not exclude the other children from school, and need not expect to endanger the public by such negligence. Of course, Dr. Doty would have us examine every child probably that went from this family in which there was scarlet fever, at the door of the school house with a clinical thermometer, and would not care what clothing the children wore so long as their temperatures were normal.

Dr. C. P. Wilkinson, of New Orleans, La.—If I understood the purport of Dr. Doty's paper rightly, it was on marine sanitation and quarantine, and that he treated the subject from that standpoint. When he referred to healthy people not conveying infection, he meant the clothing of healthy passengers and the clothing of the crew on board ship. I agree with Dr. Doty in that particular.

I also agree with the criticism made by Professor Robinson regarding the possibility of the transmission of infection from cargoes of rags. Dr. Doty goes a little too far in that regard, and he has overlooked the fact to which Professor Robinson called attention, namely, that there is great danger of infection from rags. There is likewise great danger from the dust in wool from animals that have died of anthrax or that have come in contact with anthrax. Dr. Doty in his paper refers almost entirely to those articles that have been more or less exposed to the plague, smallpox and yellow fever—cargoes that have come from plague centers, gunny bags from East India, and matters of that character. I fully agree with him in his statement that cargoes not infected are not dangerous, and when proper measures of disinfection have been carried out they must not be looked upon as dangerous. We should constantly keep before our minds that human infection is associated with human excretion. Of course, tuberculosis from animals, and anthrax from other animals, and diseases of that character, are exceptional, and I am speaking generally now. No cargo or clothing of passengers that has not come in contact with infection should be regarded as infected. When a ship sets sail from a port and it is loaded with cargo under seal, if it has not been exposed during the journey to infection from any source, it is practically a barren soil for germs to exist on, and that cargo is free from any danger of carrying general infection to the public.

Dr. Frederick Montizambert, of Ottawa, Canada.—Dr. Doty's paper is an individual one, not a report of the committee. Having heard it and the discussion on it, I should decline to accept it as bearing the sense that Dr. Bracken gives it, but I am willing to accept it in accordance with the explanation given by Dr. Wilkinson. The views of the essayist regarding maritime sanitation we may accept without any question whatever. If a case of sickness occurs on board, as smallpox or the plague, for example, and has been accurately and promptly diagnosed by the ship surgeon, and isolated in some part of the ship, as the stern or elsewhere, you do not tell me that the sailors in the fo'castle are going to carry that disease, whatever it may be. That is practically what Dr. Doty seems to me to mean.

The question of infection from cargoes was thoroughly threshed out at the International Quarantine Conference in 1897, and rules and regulations formulated and accepted by the Conference, signed by the different delegates from different countries, including those from the United States, and subsequently confirmed the following year. One of the rules laid down was that new merchandise is free from danger of infection, and should be accepted in all ports on arrival. That seems to cover the question of cargoes.

In regard to rags, there is a difference between rags coming from a smallpox infected country, and from one infected with either cholera or the plague. Those of us who have studied the question of collection of rags to any extent know that the rags that come to this continent in bales are not gathered up in a sickroom or the streets and put on board ship in a day. They go through certain processes, and then the rags unfit to be taken away and sold for use in any way, are exposed to a long process of drying before they are baled at all. They are then baled by hydraulic pressure, the rags are shipped absolutely dry, so as to guarantee that the bales are not going to sweat and ferment and spoil. From what we know of the cholera microörganism and the plague bacillus, they perish upon drying. Therefore, it seems to me, that rags so prepared, handled, and dried as to be fit to be baled under hydraulic pressure and shipped to this country, cannot be considered as a source of danger for either the spread of cholera or bubonic plague.

As to smallpox, I am not prepared to say anything so definite, because the microörganism of this disease has not been isolated or cultivated. I should be afraid to advise my government to admit rags that had been collected in a country where there had been epidemics of smallpox, even after they had been subjected to the process of drying described, although we now admit rags that are baled under

hydraulic pressure and properly bound with iron, accompanied with the ship's guarantee that they have not been collected in an infected district.

With regard to the use of the clinical thermometer with a view to detecting, if possible, the existence of bubonic plague, etc., we insist upon its use since there has been an immediate threatening of plague in this country and Canada, and we have arranged to have the temperature of all persons on board ships coming from infected ports taken within twenty-four hours before arrival at the quarantine station. The taking of these temperatures can do no harm, it is a certain amount of help to the quarantine officer and it may attract the attention of the ship's surgeon to suspicious cases, and it ensures his seeing everyone on board shortly before arrival.

The question of interfering with travel and traffic has been touched upon, and we as officers engaged in quarantine work must always recognize that quarantine methods are more or less of a transitory nature. It is to be hoped that the time may come, although I think it is still distant in this country, when inland sanitation will be so perfected that we may be able to trust people coming from an infected ship, who are not actually sick, to go forward with notification to the inland officers that they be kept under surveillance sufficiently long and thus do away with the necessity for detention under observation of healthy people at quarantine.

Dr. Bemjamin Lee, of Philadelphia, Pa.—There is one expression in the paper of Dr. Doty which I do not think should appear in our volume of Transactions, that is, the instinctive knowledge on the part of the physician that he cannot carry infection from the sickroom. I would like to know by whom that instinct has been implanted in the breast of the physician. I, for myself, have never been conscious of possessing such an instinct. Unless we adopt some precautions, as we now understand them, we may carry infection from the sickroom, and I do not think it wise that an assertion of this kind should go forth from this Association.

Dr. H. M. Bracken, of Minneapolis, Minn.—Of course, with the interpretation which Drs. Wilkinson and Montizambert place upon this paper of Dr. Doty, I would not disagree for a minute. I take practically the same position as that of Dr. Montizambert. But here is what Dr. Doty says: "Contrary to popular belief, the most careful investigation, both from a scientific and practical standpoint, has demonstrated that the clothing actually worn by well persons is not a medium of infection." This is the statement to which I take exception.

Dr. Samuel H. Durgin, of Boston, Mass.—I endorse the paper of Dr. Doty, and I think he has given us timely and wise suggestions. Too much attention and too much belief in the infective principle in cargoes have been indulged in in our quarantines in this country, to say the least, and I believe we have detained more cargoes and injured commerce more by a false belief in the infectiousness of cargoes than we should have done. I believe personally that the personnel and vessels should be more carefully looked after and less care given to cargoes and well persons' clothing. The old rag question has been referred to, and in my opinion there is much more danger in domestic rags than in foreign rags. That which has brought the foreign rag to our attention more than anything else has been a fear of cholera. Not a single instance has ever been brought to my attention where cholera was conveyed to this country through the medium of old rags. We import millions upon millions of bales of rags into this country every year, a very large proportion of which are handled in Maine and Massachusetts. The most careful scrutiny and closest investigation has failed to reveal a single instance where cholera has come with the rags; and as Dr. Montizambert has well said, it seems utterly ridiculous to think that the cholera germ could live through the processes incident to the gathering, preparing and shipping of rags to this country.

I believe that Dr. Doty had in mind, in writing this paper, the passengers and crew on board the vessel, and I think he is mainly, if not entirely, correct in assuming that a person, ninety-nine times in a hundred, must have the disease in order to convey it to others on his arrival in this country, and that his clothing is a very small factor, if it should be considered at all, in bringing from one port to another any infectious disease. I still believe that Dr. Doty's paper has been properly aimed, and is mainly right.

Dr. C. H. Jones, of Baltimore, Md.—As a member of the committee also a health officer, and quarantine director, in our city (Baltimore), I deem it wise to say something on this paper. I take it that the remarks of Dr. Doty apply entirely to vessel quarantine. It is a somewhat unfortunate expression that he used in regard to the clothing of physicians not carrying infection. It is certainly unfortunate until we know positively the truth of it.

A short time ago I received a communication from the United States Marine Hospital Service, which was the direct result of what Dr. Doty recommended to that service, as I understand. Dr. Wyman, in his letter to our Health Department, credited Dr. Doty with the suggestion, and part of the suggestion is what Dr. Montizambert referred to as being the practice in Canada, that of using

the thermometer by ship's physician or captain twenty-four hours before entering the harbor, and the physician or captain give the result of the examinations to quarantine officer. I think it was the desire on the part of Dr. Doty to take a more advanced position than quarantine officers are now taking. Personally, I do not think that we have done wrong in the past. We have detained cargoes because the evidence has been sufficient to justify us in doing so. Certainly, our experience in the past few years shows that we can practically ignore the cargo, ignore the clothing of sailors, etc., when we have unmistakable evidence from the ports from which the vessels sail that they have not been exposed directly to infection. I think the reports we get from our Consuls and health officers from such ports in Europe and in South America are perfectly safe guides except in those cases where we have elevation of temperature in any of the passengers or crew.

Dr. Samuel H. Durgin, of Boston, Mass.—I desire to state that taking temperatures of passengers on all ocean steamers is now being done in New York and Boston, and the suggestion so far as our city is concerned, came from Dr. Doty. We permit the surgeon on board to take the temperatures of passengers any time within twenty-four hours before arrival, but we do not recognize this work by any one evidence. Where a ship comes from an infected port, we detain the passengers and have their temperatures taken by our own physician. We find it a valuable means, and it saves a great deal of work at the port of entry.

Dr. Probst.—Is that customary with all ships?

Dr. Durgin.—No, but merely with all foreign vessels.

Dr. Probst.—How long has it been in force?

Dr. Durgin.—It has been in force a little less than a month in Boston, but in New York about two months.

Dr. Probst.—I happened to know of a ship that arrived on the 22d day of September carrying some 600 emigrants, not looking very clean, and I have reason to believe that no temperature records whatever were taken of these passengers.

Dr. Peter H Bryce, of Toronto, Canada.—In order that we may be very clear as to what the members of this Association really think on this extremely important subject, our views should be positively presented, so that there will be no mistake. In view of the importance of the subject, I shall refer briefly to one or two points in the paper, not with regard to the clothing of sailors, but the clothing of persons who have been handling sick people and have come in con-

tact with infectious diseases. (Dr. Bryce then read the following quotation from the paper of Dr. Doty):

"In discussing this subject some time ago with a distinguished health officer, he emphatically endorsed the statement which I have just made regarding the clothing worn by well persons, and stated that in his personal experience, covering a period of thirty-five years, he could recall but one case where the clothing, worn by a well person, could have been regarded as the medium of infection. After an experience of twenty years I can bring to my mind but one instance of the kind."

There is no doubt, after reading that, as to what Dr. Doty intended, For one, as a member of this Association, working not necessarily with those who have been exposed to infection on ships, but exposed to infection in cars, in houses, in hospitals, I protest absolutely against any such statements going out as the opinion of this Association, and to bring it close to us I will cite only one recent example.

A case of smallpox came in by way of Victoria or Vancouver in the month of March last. No other cases occurred amongst the passengers of the ship. This man passed quarantine as perfectly well. He came on from Vancouver as far as Winnipeg, was taken from the car suffering from some unknown disease, and died within forty-eight hours of what proved to be hemorrhagic smallpox. The Pullman car, in which he rode, passed on to Montreal. It will be remembered, that within the next forty-eight hours there was nothing left there except the car or the hangings or clothing of the car in which this gentleman had been. Some of the passengers had undoubtedly been exposed prior to the car reaching Winnipeg, while others, we may assume, were exposed to the breath of the sick man. Other persons, who got on the car after it left Winnipeg, at Port Arthur, or the station east of Port Arthur, took the disease, and it was twelve days before the first person was taken sick with the disease after exposure. This one case multiplied itself into half a dozen foci in the Provinces of Ontario and Quebec in the next six weeks.

Dr. Montizambert will recall that in 1886 some Russian emigrants, who had been vaccinated, passed up the St. Lawrence; one or two of them, taken off the vessel suffering from smallpox, having been left at the quarantine station at Grosse Isle. Some of the emigrants went on to Manitoba, some to Northern Michigan, still others to Southern Michigan and Illinois. Dr. Montizambert will doubtless remember the old genæological tree in the report of the Provincial Board of Health of Ontario for 1886, showing that smallpox, in a man unvaccinated, was carried to at least four States either by clothing, the

individuals themselves, their apparel, or, as in the case of diphtheria, they carried the germs on their mucous membranes. At any rate, the fact was developed that these passengers, who went on after vaccination, carried the disease into four different States and never took smallpox themselves.

It would be extremely unfortunate that any statement such as I have read from the paper of Dr. Doty should receive the approval or endorsement of this Association as a body, and there can be no doubt as to what he means from the quotation I have read.

Dr. Frederick Montizambert, of Ottawa, Canada.—I wish to add a word or two concerning the excellent paper of Dr. Iglesias, and to speak of one important point, namely, that of disinfection and vaccination being done at the port of departure, instead of the port of arrival. In doing this in Mexico, as I now understand him to say they do, they have almost reached the ideal. It is doubtful whether this could be done as completely in Europe or in the Orient. It is certainly a new departure in maritime sanitation on this continent, and it is a bit of information which should not pass without some recognition.

Dr. Samuel H. Durgin, of Boston, Mass.—I warmly endorse the sentiments expressed in the paper of the gentleman from Mexico, also what has been said by Dr. Montizambert. Vaccination is now generally done after the vessel has departed and before its arrival in port. We started this in Boston some fifteen or twenty years ago by charging the ship twenty-five cents each for the vaccination of all those who appeared to need it, and in some instances it amounted to four or five hundred dollars for one vessel. The result was the vaccination was done by the ship's surgeon after passage or before embarkation. I believe in the inspection of passengers and of cargo at the point of departure.

[Note by the Secretary.]—When the resolution offered by Dr. Bracken, given on page 283, came to the Executive Committee it was voted to refer the paper of Dr. Doty to Dr. Durgin, with the request that he confer with the author and learn whether the paper correctly stated his views on the subject presented. The following letter was received from Dr. Doty, and inasmuch as he was not present at the meeting to take part in the discussion of his paper, it has been deemed proper to publish it in the Transactions:

Dr. C. O. Probst, Columbus, O.:

Dear Doctor—I have received a letter from Dr. Durgin regarding the matter which you refer to in your communication of November 19th, and have written him that I would under no circumstances

modify the statements made in my paper which was read by Dr. Horlbeck at the meeting of the American Public Health Association. What I presented was not a theoretical conclusion, but a plain statement of facts which have come under my observation during a continuous experience of twenty years with infectious diseases both in connection with this Department and the New York City Board of Health. I am well aware that what I said is antagonistic to the views held by many physicians, nevertheless it is the result of careful, practical observation, and such observation must receive the most careful consideration in making rules and regulations for the protection of the public health. Does it not seem rather impolitic for the Association or its Executive Committee to formally oppose the views thus expressed without an exhaustive analysis and investigation, which to say the least would take considerable time. Some of the most careful observers both in this country and abroad are in accord with the views which I have presented. As a matter of fact, these views are apparently endorsed by the medical profession both in private practice and in matters relating to public health, inasmuch as physicians daily visit infectious disease and go from them directly to other patients without disinfection and change of clothing. Moreover, health departments throughout the country permit their inspectors and diagnosticians to visit infectious disease in the same manner. In families where scarlet fever for instance exists, the adult members who are actively employed outside are allowed to continue their business without interruption. Of course, they are usually admonished not to enter the apartment of the sick when at home. This you know as well as I is frequently disregarded, besides in a large percentage of the cases the patient roams about the house or apartment at will. Therefore, if the clothing actually worn by well persons was a medium of infection to the extent which is commonly believed, we would certainly and surely have indisputable evidence of it, which we do not. If such were the case physicians and health department officials would be continually aiding and abetting the propagation of infectious disease in the most serious and pronounced way, inasmuch as they go directly from one patient to another, sometimes within an interval of only a few minutes. I have distinctly and clearly stated in my paper that infectious diseases may in some instances be transmitted through the medium of the clothing of well persons. This statement gives no license to ignore reasonable precautions which may be deemed necessary to prevent the transmission of infection in this manner. I believe this answers the point raised by the committee regarding smallpox quarantine. As a matter of fact a smallpox patient should under no circumstances remain with the family; and either the patient, or the remainder of the family should be removed from the immediate premises. Therefore, no excuse would exist for persons aside from the nurse or physician visiting or being in contact with the patient, which would be done at a personal risk.

My object has been to show that infectious diseases are not commonly transmitted in the clothing actually worn by well persons, and we must not give this undue consideration in making rules and regulations for the protection of the public health. While this does not release us from every reasonable effort to prevent danger from this

source, it teaches us that we must also look elsewhere for the origin of outbreaks of infectious disease. It is an easy means of satisfying ourselves and the public, to assume that outbreaks of smallpox, scarlet fever, etc., have their origin in infected clothing worn by well persons, whereas, in many of these instances the appearance of disease is unquestionably due to mild, ambulant or convalescent cases in our midst which are unrecognized. If we are satisfied that in some way the clothing of well persons is responsible for the outbreak, then we are apt to make no further investigation; which I believe to be decidedly wrong. Bacteriological research goes far toward confirming what I have already said regarding this matter, and we know that pathogenic organisms are exceedingly short lived in the presence of air and sunlight. My experience in the New York City Board of Health for fifteen years before assuming this office, both in the capacity of diagnostician and as Chief of the Bureau of Infectious Disease, has given me an opportunity for the investigation of this subject which comes to very few. As I have already said to Dr. Durgin, we cannot preach one thing and act another. If it is true that the clothing of well persons commonly acts as a medium of infection, then both physicians and health departments are committing a serious error in the manner in which they visit these cases. On the other hand, if the clothing actually worn by well persons only in rare instances acts as a medium of infection as I believe, then the attitude of physicians and health departments in regard to their inspection of these cases is proper. Very truly yours,

(Signed) A. H. Doty.

On motion, the Association adjourned until 3 p. m.

First Day—Afternoon Session.

The Association reassembled at 3 p. m., and was called to order by the President.

Dr. A. Walter Suiter, of Herkimer, New York, read the "Report of the Committee on Cause and Prevention of Infectious Diseases." (See page 69.)

Dr. Horlbeck.—Dr. Walter Reed, of the United States Army, has a paper on "The Etiology of Yellow Fever," which may be of interest to the Association, and I move that he be permitted to read it at this time. Seconded and carried.

Dr. Walter Reed then read a paper on "The Etiology of Yellow Fever." (See page 37.)

Dr. Eduardo Licéaga, of Mexico City, Mexico, contributed (by title) his "Ninth Report on Yellow Fever in Mexico." (See page 34.)

Dr. Henry B. Horlbeck, of Charleston, South Carolina, read the "Report of the Committee on the Etiology of Yellow Fever." (See page 28.)

Dr. F. W. Elgin, of Philadelphia, read a paper on "The Influence of Temperature on Vaccine Virus." (See page 80.)

On motion, a paper by Dr. Salvador Garciadiego, of Guadalajara, Jalisco, Mexico, entitled, "The Only Certain Prophylaxis Against Smallpox is Human Vaccine, which, if well Inoculated, Does not Transmit any Infectious-Contagious Disease, or Leave any Predisposition to Disease," was read by title, and referred to the Publication Committee. (See page 84.)

Dr. Francisco P. Bernaldez, of Mexico City, Mexico, read a paper on "Prophylaxis of Human Vaccine; Its Advantages and Disadvantages." (See page 87.)

A paper by Dr. Eduardo Licéaga, of Mexico City, Mexico, on "The Jenner Vaccine, Well Preserved and Carefully Protected, is a Permanent Preservative Against Smallpox," was read by title. (See page 92.)

Dr. H. C. H. Herold, of Newark, New Jersey, followed with a paper entitled, "Newark's Diphtheria Antitoxin Plant, Its Results and Cost." (See page 98.)

On motion, the Association then adjourned until 8 p. m.

First Day—Evening Session.

The Association reassembled at 8 p. m., and was called to order by the President.

Prayer was offered by the Rev. Mr. Brown, of Indianapolis.

The President introduced as the first speaker of the evening, Ex-President Benjamin Harrison, of Indianapolis, who welcomed the Association to the city. Among other things Mr. Harrison said: "Sometimes the local committee unduly interrupts your more profitable discussions to give an exhibition of what we call local talent, or to make a display of historical fossils. The welcome that I extend to you on this occasion is purely unofficial, but none the less hearty. I hope you have not found us sinners above all men against the laws of health. Your inspection will probably be of the personally conducted variety where one sees only the attractive things. Dr. Hayes, I am sure, would show discretion, but Dr. Hurty, I fear, will, in the interests of cold science, show you all that is bad in the city. But at least you will find us intelligently alive to sanitary science and to our own needs. We are a healthy, busy people, but take a good deal of time for thinking, and have a good-sized fraction to spare for suitable attentions to distinguished guests. You are working on right lines disinterestedly and scientifically, though long life is not

always a blessing to man. Sensitive souls and stomachs have squirmed a little at the disclosures made by your investigations. We have been afraid of large things—of Indians, grizzly bears, mad dogs and other things, which we could either shut out or shoot, but you have disclosed to us that our internal organs are all the happy hunting grounds of invisible, but fatal, microbes, and that the war between good and evil is as truly being fought in the liver as in the conscience. We give you honor. We do not doubt that there are some here to-night who make a pursuit of this science who will astonish the world. In all such achievements the citizens of Indianapolis rejoice. We are not as bustling as New York and we have time, most of us, to stop and think, and we have a heart and mind to enjoy and commend such work as yours." (Applause.)

At the conclusion of General Harrison's address, Hon. Addison C. Harris, United States Minister to Austria, was introduced by the President. He highly praised the work that has been and is being done by the Association, and among other things he said: "You are not citizens of one country or another, although these flags here show you are close together—citizens of three countries, speaking one tongue, but in science there is but one world, and that is an empire, and in it all men of all professions shall devote themselves to the higher and better thought, as you have."

Dr. Charles A. Lindsley, of New Haven, Connecticut, responded to the addresses of welcome in a brief but felicitous speech.

President Bryce then delivered his annual address (See page 1), and after a brief speech by Dr. Jesus Chico, of Guanajuato, Mexico, who spoke in behalf of the Mexican delegation and the Republic of Mexico, the session ended.

October 24th—Second Day—Morning Session.

The Association met at 10 a. m., and was called to order by the President.

The Secretary presented a number of applications for membership, which having been acted upon favorably by the Executive Committee, were recommended to the Association for election.

Dr. Charles A. Lindsley.—I move that the Secretary be instructed to cast the ballot of the Association in favor of the election of these applicants. Seconded and carried.

The Secretary then cast the ballot of the Association for the election of the new members whose names had been read, and they were declared elected.

The next thing in order was the appointment of members to vacancies in the Advisory Council.

The Secretary called the roll of the Advisory Council, and vacancies were filled.

Dr. Henry B. Horlbeck.—I move that the Advisory Council meet to-morrow afternoon at 2 o'clock in one of the committee rooms of the German House. Seconded by Dr. Leal, and carried.

Mr. George W. Fuller, Chairman, then read the "Report of the Committee on Pollution of Public Water Supplies." (See page 114.)

Dr. J. N. McCormack, of Bowling Green, Kentucky.—I move that the recommendation contained in the report of this committee be referred to the Executive Committee for consideration with a view to making it a special topic for discussion at the next meeting of the Association. Seconded and carried.

Dr. A. C. Abbott, of Philadelphia.—As the opinions of the several members of the committee have been very well summarized by Mr. Fuller in his report, I move that we do not go into further details, but proceed to the discussion of the report. Seconded and carried.

DISCUSSION ON THE REPORT OF THE COMMITTEE ON THE POLLUTION OF PUBLIC WATER SUPPLIES.

Mr. Rudolph Hering, of New York, N. Y.—It often happens that reports of this nature, making recommendations for future action, are presented by those who are not only especially interested in the subject, but also somewhat enthusiastic and inclined to take ideal and sometimes impracticable views of the subject. This report is clearly not of that kind. I was very much pleased to look it over, and I can say that in my opinion it is very judicious, carefully framed and eminently practical. In other words, the recommendations are of such a nature that we may have reasonable expectations of seeing them carried out. The subject has been so thoroughly covered, that it is hardly possible for me to add much except to go more into details and perhaps speak more fully of some of the recommendations.

There are three items to be considered in establishing a water supply: (1) To give proper pressure; (2) to have the proper quantity for convenience and usefulness, and (3) to have the proper quality.

Most of you know that we have a bad reputation in this country for wasting a large amount of water. The consumption in our cities is very much greater than almost anywhere in Europe, and it is hardly understood how this condition can be endured. We know why it is so. It is not because we use very much more water than

they do in Europe, although I think we do use more, but the chief reason for this large consumption lies in the fact that we are more careless than they are in Europe, in that we allow our fixtures and cisterns in houses to leak more freely and to keep the works in less good repair. As a rule, our pipes are not laid as well as those in Europe, and we have leakage from them. And the figures given in the reports of water boards do not always correctly represent the actual consumption of water. They generally give too great an amount, due to the fact that the usual system of measurement which is ordinarily adopted at our pumping stations is not a very good one. So, if we add all these causes, the discrepancy can be accounted for, and as we go along there is no doubt, in my opinion, that our consumption per capita will be decreased gradually and brought to somewhere near what it ought to be. At the same time, we must realize in this country, as well as in Europe, that legitimate consumption of water is constantly increasing; not alone that we use more water individually, but that we have more uses for water in the way of small manufacturing industries, requiring a large number of apparatus, so that we find in nearly all of our cities that the legitimate water consumption is increasing. When, therefore, it is recommended to purify the water for a city's supply, which, of course, means added expense, we are confronted with a tremendous mass of water needing treatment, which makes it a great deal harder to establish purification works in this country than in Europe. That is one of the reasons why we have not been adopting purification works very rapidly. The difficulties are sometimes great. It is not so much a question of engineering as of human nature. You cannot change the habits of the people; you cannot in a short time stop all leaks. An estimate was recently made in New York City which showed that to repair the leaky street mains would require about twenty years. We must, however, establish works of purification, and we are obliged in this country, from a practical standpoint, to estimate the cost of works to purify this large amount of water. In New York City a report was recently made in which we felt obliged to estimate the cost of works for the consumption of 115 gallons per head per day, which is more than any city in Europe has. In Philadelphia last year a report was made recommending the filtration of water to an amount equal to 150 gallons per day. We were told that it was unnecessary to have that much water for each person, because half of it was wasted, a point which everyone must agree to. But it is the practical not the theoretical position which administrations must face, and so they generally conclude to provide for a liberal amount, trusting that gradually the extravagance will be recognized, and that gradually the waste can be

reduced, so that waterworks that are put in for this large amount of work at the outset will simply last longer before they will have to be increased in size. A good many engineers have expressed their views as to the standard character of water for future supplies, and these views have been embraced in this report. We cannot, of course, come up to the desired condition immediately, but it is hoped we may pretty soon. Europe is practically up to that standard to-day. There are only two kinds of water supplies which we should furnish our citizens; one is spring or ground water, practically the same, a water that has been purified by nature, and the second is filtered water, which is purified artificially. Even waters from mountainous regions need purification, for we cannot absolutely control any surface water, we cannot prevent all pollution of it. Many of you doubtless remember the outbreak of typhoid fever which occurred some years ago at Plymouth, Pennsylvania, where the typhoid excreta of a single individual polluted a mountain stream which supplied a certain part of the city with water, and caused an epidemic of typhoid fever in that particular part. There were 1,100 cases with over 100 deaths. Careful bacteriological and chemical analyses then failed to detect any defect in the water. We have had many other epidemics of typhoid caused in a similar way, and for that reason in Europe they consider ground water or filtered water, carried to the consumer without seeing daylight, or without being exposed to dust, to be the only safe water supply for a community. That idea is growing rapidly also in this country, and it seems that as soon as we can afford to pay for it, the same plan will be followed.

With reference to the question of sewage purification work, permit me to say a few words. As has been stated, the system of intermittent filtration for purifying sewage is nothing but a repetition of nature's work. When rainwater falls down it is full of bacteria and dust, and when it reaches the surface of the ground it mixes with other materials on the surface, and is not at all clean or pure. It then begins to filter through the soil, and naturally does what we try to do artificially with the intermittent system of filtration. It percolates down to the level of the ground water, and on that level it flows to the spring, to the brook, or river. In artificial work we are usually limited as to ground. In some cases we must seek even for some other means. This effort has caused many dissertations recently, and it may be said we are still not clear as to how we can purify sewage in the best manner in all cases. The subject is still in process of development. The trouble arises from the fact that sewage contains suspended matter, which soons fills up the pores, and the field becomes unusable; therefore, it is necessary to get most of the

suspended matter out of the sewage before you put it on land. Then, instead of filtering perhaps only from twenty-five to fifty thousand gallons per acre, you can filter perhaps as many as five hundred thousand gallons per acre. The difficult point is how to get out the suspended matter in the most effective and cheapest way. That can be done by sedimentation, allowing the sewage matter to rest and to let the suspended matter settle naturally. As much as 40 per cent. may thus deposit in a day. Another way, possible under some conditions, is to help the sedimentation by adding precipitants or chemicals which will coagulate and hasten the deposit. Another method is a coarse straining system. But a coarse strainer will sooner or later fill up, and the whole material must be dug up, taken out, and replaced. All these questions can to some extent be accurately figured out, so that a comparison can be made as to what these processes will cost. The newest method that has been proposed is the septic tank action, with which many of you are familiar. This is being tried in England in various places, and experiments on a large scale are being made in Hamburg. During a recent visit to Europe I was disappointed with the actual results obtained with the septic tanks and contact filters, in view of the promises that had been made. Much remains to be developed before these processes can be made thoroughly satisfactory. It may be said that the materials used for the rapid filtration in contact beds, such as coke, or, in England, burnt clay, are not permanent. The interstices not only fill up gradually, but the material disintegrates, and it is only a question of time when the whole mass will have to be taken out and replaced.

Mr. John W. Hill, of Cincinnati, O.—I have hastily read the report of the committee. It has performed its work with a good deal of care, and has dealt with the subject of sewage purification in a practical manner. As the report touched upon all the material questions in connection with the treatment of polluted waters and the treatment of sewage, I have jotted down rather hastily three or four suggestions that have been brought out by the reading of the report, and the first refers to the needless waste of water.

1. One of the chief obstacles to the more general introduction of works of water purification in the large cities of the country is the very large per capita consumption, which in many cases represents an unavoidable waste quite equal to 100 per cent. of the actual use and unavoidable waste of water.

2. In cities of Europe, where works of filtration have been in use in some instances for more than fifty years, and where there is no hesitation in undertaking the purification of the most polluted river

waters by plain sand filtration, the consumption of water ranges from 11 to 53 gallons per capita per diem, and will probably average less than 30 gallons per capita per diem, or from one-third to one-seventh the per capita consumption in the large cities of this country. In other words, in order to purify the water supply of a city in this country, we are required to construct and maintain works of filtration from three to six times as large as would be required for a corresponding population abroad.

3. But little thought, or, at least, but little known effort, has been made to reduce the cost of plain sand filtration by preliminary treatment of the water other than by sedimentation in large reservoirs. Large subsiding basins are expensive; not only as in the case of built-up cities, in the land which they occupy, but in the construction of the reservoirs *per se;* and if by mechanical appliances, namely, rough preliminary filters, a large percentage of the mud and grosser suspended matters can be removed from raw waters before they are put on plain sand filters, it is thought that the cost of water purification may be materially reduced, and that the combined cost of operation and maintenance, plus annual fixed charges, may be less by this method of dealing with polluted waters than by the generally accepted process of subsidence combined with filtration.

4. In certain quarters in this country and abroad, it is held and known to be true that when a polluted surface water has been brought by filtration to a degree of limpidity comparing favorably with distilled water, that such water is so low in bacterial contents as to be safe and acceptable for domestic use. Accepting distilled water as a standard, filtered surface water, comparing favorably with the distilled water, when viewed in glass flasks or tubes under like conditions, may be accepted as potable water in the absence of bacteriological tests. Attention is drawn to the fact that since the appointment of Dr. Thorpe as the official examiner of water supply of the city of London, no bacteriological tests of the raw and filtered water have been made; and to the results of the investigation made by Colonel A. M. Miller, in charge of the Washington aqueduct, which shows that the absence of turbidity is accompanied by a substantially corresponding absence of bacteria in the filtrate. Of course, it must be understood if there should be any objection to a surface water by reason of its mineral constituents in solution, that filtration will probably have little influence upon any of these excepting the dissolved iron.

5. An attempt at the present time to supply a filtered surface water absolutely free from disease germs, and wholly innocuous to health, would be accompanied by a cost which would prohibit its use upon a large scale for city supply. Upon the other hand, with a rigid curtail-

ment of the avoidable waste of water in large cities, the cost of constructing and operating works of water purification will come within the reach of any city which really desires to cultivate the public health, so far as this may be influenced by the public water supply.

Mr. F. A. W. Davis, of Indianapolis, Ind.—The committee defines what constitutes a satisfactory water supply in the light of our present knowledge.

The requirements mentioned are reasonable, and are attainable, as the committee suggests, "at a cost dependent upon local conditions." It points out that the cost can, to a certain degree, be offset by restricting the waste. This is a difficult proposition, because of the general belief that water should be free as air. Meters have been suggested. While there is no question of the equity of the proposition, yet the people as a general thing do not approve of a meter system. Preliminary to the attainment of the requirements of the committee, it is essential that the water that is to be provided for the use of the citizens should be kept as far as possible free from pollution. The committee rightfully devotes much of the report to sewage pollution, and it is well that it does, as it is certainly in line with the aims of this Association. It does not seem reasonable for a city or manufacturer to pollute the entire stream for the sake of getting rid of their refuse. In doing so, they invade the riparian rights of owners of land bordering on streams. It is just as incumbent upon the city and manufacturer to take care of their refuse as it is for the water department to furnish a potable water. It is essential to the furnishing of potable water that stream pollution should be prohibited, not only by State legislation, but by the general government, for many of the streams flow through different States.

The committee says: "At the present time there is a considerable portion of the inhabitants of the various centers of population which recognizes clearly that they are entitled to a water supply which shall not transmit to them water-borne diseases."

Water purveyors agree with the committee, but they believe, however, that an ounce of prevention is worth a pound of cure, and that it is expecting too much of the water purveyors to furnish an ideal water when the city and manufacturers throw into the streams, from which the supply is obtained, germs of death-producing diseases. The committee, in giving prominence to sewage purification, as well as the purification of water supplies, has acted wisely. The report of the committee is valuable to every water department, inasmuch as it gives to them a basis to work from which must result much good. Recognizing the vast importance of pure streams to inhabitants of this State,

the Supreme Court, in a recent decision, finds the following to be the law and upholds it:

"1. A manufacturing concern, located on the banks of the stream which it fouls and pollutes by discharging refuse therein, so as to deprive lower riparian owners of the use thereof, may be enjoined from continuing the pollution, and such riparian owners may recover damages for the injury.

"2. The fact that the concern has expended a large sum of money in the construction of its plant, and that it conducts its business in a careful manner and without malice, makes no difference in its rights to the stream.

"3. Before locating the plant, the owners were bound to know the rights of riparian proprietors and to determine a location at their own peril, considering the capacity of the streams, etc.

"4. The fact that a water-course is already contaminated does not entitle others to add thereto, nor preclude persons through whose land the water flows from obtaining relief by injunction against its further pollution.

"5. Where the complainant, without notice or knowledge of the proposed corruption of the water, invited the erection of the plant at the place where it is located, he is not estopped from asserting a claim for damages and injunction."

If the law thus protects an individual in his broad acres, how much more important is it that it should protect streams from pollution whence water is drawn for the use of the inhabitants of the State?

The committee calls attention to the advancement in methods of purification of water, but it does not, in my judgment, emphasize the importance of keeping the streams from which the supply must be taken from being polluted. Often the pollution is so gross that the streams are an offense to the sight and smell. Anyone can readily realize the impossibility of making an ideal water out of such a supply.

The report of the committee as a whole contains much valuable information upon vital subjects, and is well worth thoughtful consideration.

Mr. H. W. Clark, of Boston, Mass.—I did not have an opportunity of seeing the report of this committee until yesterday and I have only looked it over very superficially. It is a conservative report, as it should be, and as we should expect from the committee appointed. There are one or two points given in it which I should like to discuss for a moment or two.

The data that have been accumulated during the past few years upon the purification of water from a bacterial standpoint by sand

filtration, are very large, but our knowledge in regard to the success of various methods of removing color from highly colored water and organisms that cause tastes and odors in waters is very limited. We know hardly anything, in fact, in regard to practical methods of removing odors that sometimes render a water supply very disagreeable to its consumers. But, as the report mentions, the public is beginning to be educated up to the point where it not only demands a water free from disease germs, but one that contains very little color and is free from disagreeable tastes and odors such as we have in some water supplies in the east, and also free from silt and other matters to render it turbid, such as you have in some of your western waters. An instance of this demand is presented by the city of Springfield, Massachusetts. This city has obtained a considerable portion of its water supply for many years from the Ludlow Reservoir, so-called. This is a shallow basin and the water from it is often very highly colored, and at times also has a very disagreeable odor imparted to it by a vigorous growth of various organisms. In fact, it is of such a quality that during the past year the city has proposed obtaining another supply of clear, colorless river water from a source twenty miles distant from the city. Our legislature took the position, however, that this water properly belongs to the people in that section of the state, rather than to Springfield and that, if the present Springfield supply is adequate in quantity, Springfield must find a way to render it satisfactory in quality. Hence, the water commissioners are now beginning, after receiving an appropriation of $12,000 from the city council, to conduct experiments in regard to the removal of organisms, odors and color.

In that portion of the report of the committee referring to sewage purification, I noticed with much interest the comparison of the strength of English and American sewage. It must be remembered in looking over these comparisons that the figures quoted from the reports of the Massachusetts State Board of Health are of analyses of samples of sewage collected week after week and at different portions of the day, and that they show the true average, as both the weak night sewage and the strong day sewage are included. Certainly the English sewage should be stronger, on account of the small water consumption per inhabitant, but I somewhat doubt if the difference is as great as this table indicates.

In regard to the purification of sewage, we have in Massachusetts many intermittent sand filters in operation, and have been studying the subject of sewage purification for many years and collecting data regarding it. In this connection I wish to call attention to the statement in the report of the committee where it says that sand filters

used in sewage purification on a large scale may show as good results as experimental filters. I believe that they do show not only as good but better results than most experimental filters, especially when they are properly operated. Moreover, the rates at which they are operated are often greater than those of experimental intermittent sand filters.

The report also mentions the recent work upon septic tanks and high rates of filtration of sewage. Here I think we shall find a difference between operating small tanks and small filters and large tanks and large filters, that varies from our experience with intermittent sand filters. We can get very satisfactory results with small septic tanks and with the small filters of coarse material operating at high rates, but as we enlarge them the results are apparently, from experience so far obtained, not as satisfactory. I think it makes considerable difference with the septic tank process, what kind of sewage enters the tank; some sewages that have passed through five or six miles of pipe before they reach the filter area have their suspended matter finely divided and a considerable portion of the original matters in suspension have gone into solution, and the septic tank will work more easily than when the sewage comes to it in a very fresh state. However, these new methods are worthy of much study and no doubt will be of great value in the future in many instances.

Mr. C. Monjeau, of Middletown, Ohio.—I have been exceedingly interested in what has been said in connection with this report. The Chairman of the committee has certainly given us a very valuable paper, and the remarks of the gentlemen following were very instructive. But after all that has been said, I am forced to beg you to indulge me a moment or two whilst I read a few remarks from a book that has not yet been published, and which will give you an idea of what we are doing not only in the United States, but in two other great countries, namely, Canada and Mexico. (Here Mr. Monjeau read from a book written by Mr. O. G. Brown, of Minneapolis, Minnesota, on the pollution of waters, etc.).

The laws which govern most of our personal and property rights have shown radical changes from the laws of earlier times, but it is a significant fact that even the oldest decisions of American courts forming judgments against offenders who have polluted streams, lakes, or rivers, are based upon certain general principles of law which have always made such acts of pollution both private and public wrongs in the civil and penal codes of nations, and which have remained unchanged from the earliest time the written law known to history at the present time.

(Mr. Monjeau read further extracts from the same book.)

Our streams, which are really the founts of Mother Nature, should be kept pure, and not first defiled, and then filtered.

Dr. L. P. Jones, of Greenwich, Conn.—There is one point to which I desire to call attention, namely, the pollution of water by fish. I have had not a little discussion with several chemists and bacteriologists in regard to the pollution of small reservoirs by an overstock of fish in the winter-time. Some of our small reservoirs are owned by private parties. These reservoirs, when overstocked with fish and frozen, emit a very strong odor, which I believe should be remedied in some way. It is very much like putting a fish in a bottle and inserting a cork, and then, when the cork is removed, a strong odor is given off. I call attention to this point here for the purpose of seeing if any other health officer has had trouble with a reservoir by pollution with fish.

Dr. Gardner T. Swarts, of Providence, R. I.—It seems hardly necessary to contradict the opinions which have been advanced in detail in this report, but I hardly think the Association wishes to have go on record some of the statements made in the discussion, namely, that we should allow polluted water to continue to be served to a population which is obliged to depend upon it, and that we should not attempt to purify it, or that a few more deaths will make very little difference. The object of this Association is to conserve public health, to reduce mortality statistics, to lessen the work of the State Registrar; and I think some of the remarks advanced might lead those who read our discussions to believe that such are not our thoughts. The object of the report of this committee is to devise means and methods whereby waters, if their pollution cannot be stopped, shall be purified as far as possible. It is an easy matter to say that we should not pollute waters, or that we should not take water that is polluted, but if there is no other water available, we are obliged to take that water. Unfortunately we have no national control of water supplies and the small State of Rhode Island, hemmed in by other States, depends for its supply of water largely upon other States, and it has practically no redress, legal or otherwise, and is obliged to obtain it through the civil processes of the law, which we know may extend over a period of ten or twenty years, during which time the mortality statistics increase. Therefore, it seems that every effort should be made, as recommended in the report, for the protection and purification of waters, whether they be polluted or unpolluted.

In regard to the question of purification of sewage, I regret that the committee in its report did not go into details, because there is

hardly any State health officer who has not had thrust upon him, at some time or other, the question that some means be provided whereby the pollution of streams, not used for potable purposes, and contaminated by manufacturing industries, can be prevented or guarded against. Streams may be polluted with wool scourings, dye stuffs, sawdust, dairy wastes, etc. These pollutions are a nuisance, and the matter comes before the public health officer with a request that the nuisance be stopped; at the same time, the manufacturing industries, the sawmills, and the factories want to exist, and wherever they are located they bring more wealth to the community. They cannot be turned out. Provision must be made for their existence. They must receive consideration, and the necessary reform brought about by those who are interested in this matter. State boards of health can give instruction to manufacturers whereby the waste products thrown into rivers may be purified. As has been shown by work that has been carried on in Massachusetts for years, the waste products of large cities can be so purified that the offal thrown into the river is purer than the water into which it is thrown. I had hoped that I might obtain some information in regard to the septic process of disposal of sewage up to the present time, and I trust that the reader of the report (Mr. Fuller) will bring out this subject in more detail, and also refute the idea that it is the desire of the Association to increase the mortality statistics of the United States.

Mr. Frank Herbert Snow, of Columbus, Ohio.—I might say in reply to the gentleman who has preceded me (Dr. Swarts) that the State Board of Health of Ohio, about a year ago, approved plans for a sewage disposal plant for the city of Mansfield, whose operation will be watched with interest by municipal officials in the State. Lack of time does not permit a full description of the plant. Briefly the method is a combination of the so-called septic system and contact filters, provisions being made at the works for the destruction by fire of garbage and similar wastes of the city, and it is expected that the crematory will be used to destroy the solids which may accumulate in the tanks. The system will be completed and ready for operation next summer. The effluent from the plant will flow into the nearby stream, which has a watershed of about 30 square miles, and practically dries up in summer time. The city of Mansfield has a population of about 20,000, and the central part of the city is quite thoroughly sewered. Storm water passes off in the same sewers which are connected with the sanitary appliances in the dwellings, so that in times of storm the discharge of the sewers is very dilute and not liable to cause any more pollution than the natural drainage from

the streets and lots of the city, but that portion of the time when the flow in the sewers is simply the drainage from the buildings, called sewage proper, a sensible nuisance is created in the stream. Farmers living along the banks for several miles below the city were compelled to bring suit to remedy the trouble, and in some cases they recovered damages on account of the pollution. In a case like this it is likely to be impracticable to build a plant to take care of and purify the flow in the sewers in wet weather. It is also unnecessary as the natural outlet of the storm water is into a stream. This natural pollution which results from the gathering of people and the building of a large number of habitations on small areas is considered a legal pollution, and to the extent that a community has a right to pollute a stream in this manner no nuisance can legally be declared. It may be unpleasant for the owners of land below the city who formerly could use the waters of the stream for any purposes for which naturally pure water may be used, to be deprived of some of these privileges by reason of the growth of the city above them, but nevertheless courts recognize such a thing as natural pollution of streams. In solving the question of how much of the sewage from a system of pipes and drains, taking both the storm water and the sewage, shall be treated and purified, the engineer must take into account the fact that streams are considered a kind of natural carrier of filth. Manufactories have for years discharged effluent into streams and polluted them. The right to do so has become perscriptive, if not legally, in fact by the reason that the industry is essential to the community, and any plan requiring that industry to purify its wastes before turning them into the river might drive the industry to seek a location elsewhere and hence be disastrous to the community. The engineer must decide how much of the sewage in the instance cited above shall be purified and to what degree of purification the disposal works shall attain. If a very high degree of purification then the cost will be excessive; if a low degree of purification the nuisance may not be abated. In Ohio any project to bond a city must be voted upon by the electors of that community and a project, if estimated too high in cost is quite likely to be defeated at the polls. For this reason as the popular mind has not yet been educated to appreciate economies by different kinds of sewage purification, some just propositions have been defeated, and individuals whose property has suffered in value by reason of stream pollution have been forced to seek redress in the courts. The Ohio legislature last winter passed a law whereby a majority vote instead of two-thirds vote, as formerly, of the electors voting on the question, authorizes the sale of bonds for the erection and maintenance of sanitary plants. This will enable the engineer to

assist in the work of preventing the pollution of streams, and it will encourage him to recommend, with greater hopes of success, such disposal works as are required, to give the best results in the long run in every case. The Mansfield plant is to cost $85,000 when completed, and it will be capable of purifying from 500,000 to 1,000,000 gallons of sewage each day of 24 hours, depending upon the time of year and the flow in the sewers. The garbage plant will have a capacity of 15 tons per day. It is estimated that the cost of running the plant will be in the neighborhood of $2500. The cost includes a pumping station and crematory house, a sewage-receiving reservoir, the contact filters, a mile and a half of sewer and 16 acres of land. The plant is located almost in the city and will be attractive in its landscape feature.

DR. ————————————, of New York City.—I cannot presume to discuss this valuable report without, at least, some further time to consider it. In the discussion that has taken place, a slight departure has been made from the consideration of the principal topics embodied in the report, and if I may be permitted, I would like to refer to one or two points that have been brought out.

Mr. Hill has suggested that some simple method of testing the operation of filters be proposed, and has asked if a simple method would be possible. It would seem to me that instead of attempting to devise a simple method by which the operation of a filter can be gauged, it would be better to raise, if possible, the average grade of intelligence of the superintendents by whom such filters are operated. It would seem the general public has the impression that after a filter is built for the purification of a large water supply, the problem of pure water is settled. Most of us know that is not so. An efficient filter so largely depends upon the care with which it is operated, that the lines drawn by the committee in its report must verge one upon the other, so that there will be many cases in which one filter, whether English or American, will do as well as the other. Much depends upon intelligence in operating a filter. I would suggest that the management of waterworks, who put skilled and high-salaried men in charge of the pumps, place men of equal intelligence in care of filters. Then, there will be no difficulty in estimating their successful operation.

Another point I would refer to briefly is this: It is not only necessary to obtain a pure water, whether ground water or filtered water, but it is equally important to keep that water pure. If I am not mistaken, the Plymouth epidemic of typhoid fever was a case in point. The dejecta were thrown into the reservoir, and caused an epidemic of this disease among the inhabitants of that city who drank

the polluted water. In one case I examined a few years ago the water was well filtered, but became contaminated after filtration by standing in the reservoir for forty-eight hours. I think the point of keeping water pure, as well as obtaining it pure in the first place, is worthy of consideration by the members of this Association.

Mr. Elmer G. Horton, of Columbus, Ohio.—I have been much interested in the report of the committee, and think we all agree it is an excellent report. There is one point I wish to call attention to, namely, the six prerequisites demanded by the committee for satisfactory water. When we come to practical work there are waters which will fall short in one or more of those requirements. Our work in Ohio is such that we are frequently called upon to analyze water supplies, either ground water or river water. Many of the ground waters are open to one of three objections: In some ground waters we have sulphur, oil, or salt. Again, some ground waters are open to the objection given by the committee, namely, they contain a noticeable amount of iron. Lastly, nearly all Ohio ground waters are hard, containing a considerable amount of calcium and magnesium. On the other hand, with river or surface waters, and some reservoir waters, we have had trouble, in that they contain organisms, giving objectionable tastes and odors. Many of our Ohio river waters contain much clay, so that they are decidedly turbid. Again, others contain disease-producing germs, because of so much sewage introduced into the streams of that State.

Mr. Fuller (closing the discussion as Chairman of the committee).—On behalf of the committee I desire to express our appreciation of the discussion which this report has received. I would also like to speak briefly of a few points which have been brought out in the discussion, beginning with those by Mr. Hill, relative to the clarification and purification of turbid river waters.

There has recently been given, in a discussion on this topic before another organization, a summary of the leading characteristics of river waters with reference to their clarification and purification. So far as present information permits, a division has been made of the different types of water into classes. In the first class we may place those waters in which there is practically no clay, waters such as those of the glacial drift formation which are generally seen in New England and some of the Northern States. Another well-defined class is that which contains a large amount of very minute particles, and which are present in the water for months at a time without interruption. The lower Mississippi River and its principal tributaries illustrate this type of water. There is also an intermediate class, which

cannot be very specifically defined from present information, and about the purification of which there is much less practical information available to-day than is the case with the other two general types of river water.

The water of the Schuylkill River belongs to the last, or intermediate, class. I am sure that I voice the sentiments of those engaged in this special field when I say that excellent judgment is shown in studying carefully the characteristics of this water with reference to different procedures for purification, before the final decisions are made with reference to the best detailed plans for its purification on a large scale.

Referring to the use of coagulation in the purification of water, it may be said in general terms that the cases are exceptional where it is advantageous to employ coagulants with reference to the non-clay-bearing waters, exclusive of those cases where the waters are very deeply colored by vegetable stains. With the clay-bearing waters the reverse is true, according to present information, and the cases are exceptional where coagulation can be omitted to advantage. As to the question of trying to devise means to avoid the use of coagulation in the intermediate class of waters, which for short periods contains moderate amounts of clay, I agree with the point of view which has been brought out in the discussion; that is to say, that if there are other means which are at all promising in effecting the preliminary treatmeent of water, such as is accomplished by coagulation and subsidence, the practicable possibilities along such lines should be carefully studied before the final decision is made.

Concerning the bacteriological tests of the water filters at London, I think that it is generally regarded as unfortunate that they have been discontinued by Dr. Thorpe, who has recently succeeded the late Sir Edward Frankland as official analyst on behalf of the Government. At the convention of the American Society of Civil Engineers held at London last July, this topic was discussed, and it appeared to be the consensus of opinion among waterworks men that this was a step in the wrong direction. The determinations of the numbers of bacteria in water can be made by analytical methods which are simple, and which do not require more than two days before the final results may be secured. In my judgment, the value of such results is well worth the cost involved. Undoubtedly the appearance of the filtered water as a means of judging its quality is of much assistance under some conditions. This is principally so in the cases of those waters which carry a large amount of sub-microscopic clay particles. On the other hand, I do not consider that the appearance of an effluent in the case of non-clay-bearing waters is neces-

sarily of any important significance as an indication of its biological contents.

It has been mentioned in the discussion that it may not be necessary in practice to operate water purification plants with the view to securing as high an efficiency as has been the aim in the case of experimental plants, and as is regarded to be necessary by many sanitarians. It is my judgment that the evidence as it stands to-day does not justify methods of operation of water purification plants which do not yield as efficient results as is practicable to obtain. If it is considered necessary to install modern water purification plants of an efficient type, I believe that they should be well operated. From available evidence it would seem that the practicable conditions for high-grade operation are more promising than might appear at first sight. By that I mean that the total cost of purification to a moderate degree is not so very much less than the cost of purification to a degree which harmonizes with the views of leading sanitarians.

With regard to detailed information with reference to the composition of sewage, the methods of sewage disposal now being practiced and studied, and the results accomplished by the latter, this committee has been inclined to adopt the policy of presenting this information in general terms, and in the form of a series of summarized statements. The committee has spent a considerable amount of time and labor in gathering together and studying the detailed information, and in selecting those data which seem to be most specific and reliable. In view of the large amount of fragmentary evidence which is available along this general line, and which can be secured by individuals as well as by the committee, through various journals and by correspondence, it would seem to be unnecessary and unwise to burden the committee reports with needless detail.

It has been mentioned that the purification of water supplies is perhaps a wrong procedure towards providing communities with water of a thoroughly satisfactory character. In the general field of public water supplies it appears to me that we ought to consider very carefully the practical side of matters. This, of course, applies to all branches of public work, but it applies particularly to problems in water supply and sewage disposal, as the current practice along these lines becomes adjusted to the theories now held by sanitarians. Careful consideration must be given to local conditions, and the manner in which these problems can be best solved in various communities will doubtless be different in many individual instances. There are conditions in this country where at this time the most practicable means of securing a satisfactory water supply involve the purification of the water which is found in ample quantities at a reasonable dis-

tance from the city in question. In other places, satisfactory results may be obtained for a time by the purification of a comparatively small volume of sewage, and without going to the expense at once of purifying the entire water supply. In still other instances in the years to come, there will presumably be necessary the purification of the sewage entering the source of supply, and also the purification of the water as it is drawn from the stream and before it is supplied to the water consumers. As matters now stand, it does not seem justifiable to draw any sharply-defined conclusions as to the relative necessity and practicability of sewage purification and of water purification, with reference to securing public water supplies of a satisfactory character. Such problems depend essentially upon local conditions.

On motion of Dr. McCormack, the Association then adjourned until 8 p. m.

NOTE.—There was no afternoon session held, as the members and invited guests took a trolley ride to Greenwood.

SECOND DAY—EVENING SESSION.

The Association reassembled at 8 p. m., and was called to order by the First Vice-President, Dr. H. M. Bracken, of Minneapolis.

Mr. Rudolph Hering, of New York City, presented the "Report of the Committee on Disposal of Refuse Materials." (See page 126.)

Dr. Wyatt Johnston, of Montreal, P. Q., presented a verbal "Report of the Committee on the Teaching of Hygiene and Granting of Degrees of Doctor of Public Health." (See page 130.)

Dr. L. P. Jones, of Greenwich, Connecticut, read a paper on "A Scheme for Preventive Medicine." (See page 131.)

DISCUSSION ON THE REPORT OF DR. JOHNSTON AND THE PAPER OF DR. JONES.

PROFESSOR SEVERANCE BURRAGE, of Lafayette, Ind.—I have been much interested in the matter of education of medical officers of health. I consider it an interesting subject, and Dr. Johnston in his report compared our health officers with those of England and other countries. As a rule, our medical health officers have had no special training for their work. What little hygiene has been taught them has been acquired in medical schools in conection with other subjects. We find that their instructor usually has been the professor of physiology and hygiene in a medical school, or the professor of materia medica and hygiene, or possibly the professor of obstetrics

and hygiene. In other words, hygiene is usually mixed up with some other subject in medical schools, and very little attention has been paid to teaching hygiene in its practical forms. I have had considerable experience in talking with health officers throughout the country, and in nearly every case they say they wish they had time to take a practical working course in sanitary science. We have need for such instruction in our medical colleges by introducing some practical course in hygiene and sanitary science. As a rule, as I have previously said, heretofore hygiene has been mixed up with some other study, and sufficient time has not been devoted to this particular branch. Preventive medicine is important, but it is shoved in the background in medical schools and other colleges. This fact needs to be emphasized.

Some of the recommendations contained in the paper of Dr. Jones will bear careful consideration. I think a great many colleges, like Purdue University and similar institutions, which have courses in sanitary science, will be glad to arrange a course which will supply what health officers want. If they desire a course of six months, which will equip them to receive a diploma of some kind, we of Purdue University and other colleges, I have no doubt, will be glad to arrange a course that will fit such requirements and give them a diploma of Doctor of Health, or whatever the diploma is to be.

The subject is one of extreme importance. Evidence of lack of sanitary knowledge was seen in our recent wars. The medical officers in these wars were not versed in the ordinary principles of sanitation. They may have been good surgeons, but they did not know the first rules of sanitation when it came to the conduct and care of camps. We had numerous evidences of this lack of knowledge. That is only one phase where the sanitary side of their education had been neglected.

Dr. A. C. Abbott, of Philadelphia, Pennsylvania.—From what we have heard from Prof. Johnston and Prof. Burrage it is evident that this question of systematic education in hygiene is one that is attracting attention. We have realized this at the University of Pennsylvania, and are now endeavoring to formulate a curriculum that will properly lead to official recognition on the part of the University. I cannot at this moment state definitely of what the course of study will consist as we have not reached final conclusions on it. The subject is a many-sided one, and it is very difficult to decide the precise lines along which a course should be laid.

The questions that first arise in organizing this teaching are: Is it worth while to give short courses on special phases of the subject,

or shall the instruction be comprehensive, and properly equip a man for an understanding of as much of the whole subject as an individual can expect to accomplish? My feeling is rather in favor of the full university course, with the privilege of individuals taking special instruction in any one part of that course that they may desire. I do not believe this is a question that can be solved in an open meeting of this kind, though it is eminently proper to have an expression of opinion on the subject from as many as are interested in it. I would be very glad if the Association would leave this matter in the hands of a competent committee with the request that that committee report upon the subject at the next meeting. I am convinced that one of the reasons why the teaching of hygiene has not merited the respect that its importance demands is because there have been no educational requirements demanded of those who have taken up the work. In the past anyone, whether he be fitted or not for the subject, has gone into this study. As our knowledge increases, and as the scientific side of the subject develops, I think it is manifest to everyone here that the professional hygienist must have special training, and cannot any longer be an individual who knows the subject intuitively.

Dr. Frank W. Wright, of New Haven, Conn.—While I heartily agree with what both speakers have said, I have had a good many years' experience in connection with health boards, and my experience has taught me that if we could only educate finance committees and assist courts in carrying out the laws we already have, we could do a great deal more than we do now.

Dr. Charles O. Probst, of Columbus, Ohio.—The subject of teaching hygiene is sufficiently comprehensive to embrace laymen as well as health officers. I think all of us will agree that the teaching of hygiene in our public schools, as it is being taught to-day, is practically a failure. It is largely due to the fact that they are trying to teach a complex subject to young children. It is seldom that the subject is taught in our high schools.

The question of teaching hygiene in one of our universities is being talked of now by the board of trustees of that institution, as to whether it would not be proper to require everyone graduating from the university to have some training in hygiene. This matter was forced upon their attention by the case of a very bright young man, who had finished his education in that institution, had won a fellowship, but who was found to have contracted tuberculosis. His physician in looking into the origin of the case found that he had been the roommate of another student who had gone out of the university a year or two previously in an advanced stage of tubercu-

losis. This young man had contracted the disease from his roommate; and on being questioned in regard to the precautions that might have been taken by him, he said he was not aware that tuberculosis was a communicable disease, and that no precautions had been taken. It seems strange that a university, fitting a young man for his lifework, should not instruct him that tuberculosis is a communicable disease. Attention might be devoted to the feasibility of instructing laymen in certain phases of this great question of hygiene. veterinary and human medicine, especially in matters of hygiene.

Dr. M. P. Ravenel, of Philadelphia, Pa.—There is one point that has not been touched upon either in the paper or in the discussion, and that is the education of veterinarians, who are employed in such work and who assist in board of health work. I know that in Pennsylvania, Dr. Lee, the Secretary of the State Board of Health, sometimes consults, in one way or another, with Dr. Leonard Pearson, the State Veterinarian, and vice versa. A close relationship exists between veterinary and human medicine, especially in matters of hygiene. During the past year Dr. Leonard Pearson, the State Veterinarian, devised a course of instruction for the veterinary medical inspectors, who are employed in carrying out the excellent laws which Pennsylvania has for weeding out the contagious diseases of animals, particularly tuberculosis, and against the introduction of tuberculosis into the State by cattle coming from other States. By sending out invitations to these veterinary inspectors, announcing a short course at the University of Pennsylvania of lectures and demonstrations on sanitary subjects, about fifty veterinary inspectors attended who evinced great interest. This is a point which I think it would be well to bear in mind in mapping out courses, namely, what veterinarians should know about human medicine, and vice versa.

Dr. Liston H. Montgomery, of Chicago, Illinois.—I desire to say a few words on this subject. I came to this meeting knowing that this very interesting topic would be discussed. It is one in which I have been very much interested. It is a well-known fact, however, that not infrequently an executive health officer is appointed, not so much for any ability or knowledge he may have of sanitary subjects, as for his ability or skill in political matters.

I have been very much interested in the remarks of the preceding speakers, and I am heartily in favor of such a plan being adopted, so that health officers shall not receive their appointment or be considered eligible until they have received some such title as Doctor of Hygiene, conferred by a well-known university or college. I hope

the Association will formulate some plan by which such a measure may be brought about.

Dr. C. H. Jones, of Baltimore, Md.—I do not wish to prolong the discussion unduly, but merely wish to say that there is evidently a desire on the part of many that some definite plan should be adopted by this Association with reference to courses in hygiene. Something definite should be determined upon as a guide for the education of young men in sanitary science. The time has already arrived when communities should consider the abilities of the individuals who are to be trusted with the health of those communities. I wish to mention an instance with which no doubt some of you are familiar. In the college with which I am connected, we have a course on hygiene. It is purely a preliminary affair at present, because I anticipated hearing something more definite for my guidance at this meeting. The course I have established is a two-year one, the details of which I have not entered into, for the reason that I wish to conform to the standard which is required by this Association. It is highly important that the committee should be continued, or another committee appointed, so that we may have something definite for our instruction.

Professor Franklin C. Robinson, of Brunswick, Maine.—A word or two in line with what Dr. Probst has said as showing the appreciation for hygienic instruction in some places. In the college where I teach hygienic instruction is given to every student, during the first year of his course. Almost everything else has been made elective. It has been regarded, however, as absolutely essential that every young man, who goes through college, should have instruction in hygiene; should know something about how to guard against infectious diseases, what they mean, and the allied subjects, such as can be given by a competent physician.

Dr. William C. Chapman, of Toledo, Ohio.—I do not think we will be able to do what we expect unless we educate the body politic to understand that there is something in sanitary science. Our sanitary officers are too frequently elected, or appointed by political influence. What incentive will there be for a man to go through a course of years of study, added to his medical course, and when he is thoroughly prepared must drag himself into politics in order to receive an appointment? It seems to me, that we must begin with the people. As Dr. Probst has said, we must elevate the laity, and in the future we will see the benefit by having superior medical officers. I believe medical men should all be sanitarians. I firmly believe also that all States should have a course of study in hygiene, not added to another professorship, but one which will be distinct in itself, a separate

professorship being established for it. I believe the time is not far distant when the people will be able to see what preventive medicine is doing. We are now in the midst of it ourselves. We are trying to prevent disease, but do not understand fully how to do it. I am heartily in accord with what has been said regarding the education of people so that they may know there is something in preventive medicine, something in sanitary science. As long as our boards of health are made political, just so long will we be a football, and young men will not be encouraged to prepare for the work.

Dr. F. R. Belknap, of Niles, Michigan.—A recent law of the State of Michigan requires teaching in the public schools of methods of spreading the elementary principles underlying communicable diseases and their methods of restraint. This teaching is carried on under the supervision of the State Board of Health. The board has issued a pamphlet of eight pages containing, as briefly as possible, a statement of the various communicable diseases, how they are spread, and how they are restrained. This is compulsory. It is taught in all schools of the State to a greater or less extent. It has been quite satisfactory thus far.

I have noticed among the pamphlets one by Professor Burrage, of Purdue University, giving a synopsis of a course in sanitary science, which has been instituted there for several years. I have heard this course very highly spoken of by Dr. Hurty, and it is the only one I know of in this section of the country. It is an advanced course, and it is the only one that has been recognized as satisfactory. If Professor Burrage is present, he might possibly explain to us in detail what his course is, and how he carries it out.

Dr. Juan Breña, of Zacatecas, Mexico, contributed a paper entitled, "Remarks Concerning the Vice of Smoking Among Youths, and Suggestions as to the Means of Overcoming It." (See page 135.)

Dr. Manuel Gutierrez, of Querétaro, Mexico, read a paper on "Hygienic Analysis of Milk when Used for the Artificial Feeding of Infants, and Methods of Doing So with Rapidity and Certainty." (See page 140.)

Dr. Frank W. Wright, of New Haven, Connecticut, offered the following resolution, which was referred to the Executive Committee:

Resolved, That a standing committee, to be known as the Committee on School Hygiene, be formed.

On motion of Dr. Suiter, the Association adjourned until Thursday morning, at 10 o'clock.

October 25th—Third Day—Morning Session.

The Association met at 10 a. m., and was called to order by the First Vice-President.

The Secretary presented several additional applications for membership, which had been acted upon favorably by the Executive Committee, and recommended to the Association for adoption. On motion of Dr. Liston H. Montgomery, of Chicago, the Secretary was instructed to cast the ballot for the election of the gentlemen mentioned, which he did, and they were declared elected.

The next thing in order was the report of the Treasurer, which was read by Dr. Henry D. Holton, of Brattleboro, Vermont, as follows:

TREASURER'S REPORT.

HENRY D. HOLTON, TREASURER, IN ACCOUNT WITH AMERICAN PUBLIC HEALTH ASSOCIATION.

1899.		Dr.
October 20.	To cash on hand	$723 98
	To cash from transactions sold	115 60
	To cash from dues of members, 1899	1,600 10
	To cash from dues of members for other years	105 00
	To cash advanced by Treasurer	565 58
		$3,110 26

1899.	*Disbursements.*	Cr.
November 16	By cash paid on Order No. 95, Wyatt Johnson, for Laboratory Committee	$40 35
November 16	By cash paid on Order No. 95, C. O. Probst, for expenses Minneapolis meeting	90 30
November 27	By cash paid on Order No. 96, Henry D. Holton, for expenses Minneapolis meeting	100 99
1900.		
January 4	By cash paid on Order No. 97, Wm. Whitford, for reporting Minneapolis meeting	179 55
February 6	By cash paid on Order No. 98, Wyatt Johnston, for expenses as representative attending meeting of Bacteriologists	32 75
March 7	By cash paid on Order No. 99, Wm. Whitford, for retranscribing address of Prof. Welch	6 00
March 7	By cash paid on Order No. 100, A. H. Sawyer, for engrossing resolutions re Dr. Geo. H. Rohé	10 00
March 7	By cash paid on Order No. 101, C. O. Probst, for postage and copyright	26 10
April 28	By cash paid on Order No. 102, Berlin Printing Co., for printing Transactions, Vol. XXV, and other printing	1,807 56
May 22	By cash paid on Order No. 103, M. A. Tyler, for typewriting list of Members of Association	16 00
May 22	By cash paid on Order No. 104, U. S. Express Co., for transportation of Transactions	5 00

May 24—By cash paid on Order No. 105, American Express Co., for transportation of Transactions	110 02
October 17—By cash paid on Order No. 106, C. O. Probst, Sec'y, for services and expenses as Secretary	253 47
October 17—By cash paid on Order No. 107, Berlin Printing Co., for printing as per bill	96 50
October 17—By cash paid on Order No. 108, Wyatt Johnston, for printing a publication of abstracts of proceedings of Section	38 25
October 20—By cash paid on Order No. 109, H. D. Holton, Treasurer, for office expenses and money paid out as per bill	177 36
October 20—By cash on hand	120 06
	$3,110 26

Dr. Liston H. Montgomery.—I move that the report of the Treasurer be received and referred to an Auditing Committee. Seconded and carried.

The President.—I will appoint as an Auditing Committee Mr. Crosby Gray, Dr. U. O. B. Wingate, and Dr. C. L. Wilbur.

Professor F. C. Robinson, Chairman, presented a "Report of the Committee on Disinfection." (See page 151.)

The President.—Before proceeding with the reading of further papers, reports, and discussions on them, I will call upon the Secretary to present the report of the Executive Committee.

The Secretary.—The Executive Committee begs leave to report to the Association as follows: The folowing resolution has been submitted to the Executive Committee by Dr. Leal:

Resolved, That a committee of three be appointed, to be known as the Committee on Uniform Municipal Statistics, to take such steps as seem to it to be most practicable toward securing greater uniformity in all branches of municipal accounts, reports and statistics, and particularly those branches relating to vital and sanitary statistics; said committee to have power to confer with similar committees from other societies already or hereafter appointed to the same general end, and to report at the next meeting of this Association.

The Executive Committee recommends that this committee be established, but that it be included in that of the Committee on Demography and Statistics in their Sanitary Relations.

Dr. John L. Leal.—I move that the resolution be adopted. Seconded and carried.

The Secretary.—The following resolution was offered by Dr. Frank W. Wright.

Resolved, That a standing committee, to be known as the Committee on School Hygiene, be appointed by this Association.

The Executive Committee recommends that such a committee be appointed.

On motion, the report of the Executive Committee was concurred in, and the resolution adopted.

THE SECRETARY.—The Executive Committee has considered the matter of standing committees, and has recommended that they be constituted as read. (Here the Secretary read the list of standing and special committees with the changes that had been made in them by the Executive Committee.)

PROFESSOR ROBINSON.—I move that the recommendations of the Executive Committee regarding these committees be concurred in. Seconded and carried.

THE SECRETARY.—The Executive Committee has the following recommendations to offer in reference to standing committees.

1. That all standing committees appointed by the Association at any annual meeting shall exist for one year or until the next meeting, and shall be dissolved unless continued by order of the Association.

2. That the list of all proposed standing committees for any succeeding year shall be submitted by the Executive Committee to the Association not later than the morning session of the second day of any annual meeting, along with the names of the chairmen proposed for each committee.

3. That, so far as possible, the President shall, before the end of the meeting, consult with the chairmen of the several committees concerning the members to be appointed upon their respective committees, and shall appoint to the several committees members specially interested in subjects dealt with by the several committees.

THE PRESIDENT.—In connection with the morning of the "second day," it was understood, I think, at the time the Executive Committee made that recommendation, that Wednesday was the second day. I presume now, since the section on bacteriology and chemistry has become a part of the Association, that the work really begins to count on Monday, so that Wednesday would be the third day. Has anyone any suggestions to make in reference to this matter? It might be rather early to prepare a list of committees sooner than Wednesday. Before the recommendation is adopted, it would be well to decide which is our first day.

PROFESSOR F. C. ROBINSON.—I move that we substitute the third for the second day. Seconded.

DR. JOHN L. LEAL.—I now move the adoption of the recommendation, as amended by Professor Robinson. Seconded.

The recommendation as amended was put and carried.

The Secretary stated that the Section on Bacteriology and Chemistry had selected as its officers for the ensuing year the following President, Dr. Wyatt Johnston, of Montreal, P. Q.; Vice-President, Professor E. O. Jordan, of the University of Chicago; Secretary, Mr. G. C. Whipple, of Brooklyn, New York; Recording Secretary, Dr. H. D. Pease, of Buffalo, New York. Drs. Theobald Smith, W. R. Stokes, E. A. de Schweinitz, V. A. Moore, and A. C. Abbott were chosen to compose the Council.

The Secretary.—The following resolution has been acted upon by the Executive Committee, and is now referred to the Association with the recommendation that it be adopted.

Resolved, That the Treasurer of this Association be, and he hereby is, authorized to receive and give receipts for all money due and payable to this Association from any source whatever; and to endorse checks and warrants in its name, and on its behalf, and full discharge for the same to give.

The President.—You have heard the resolution. What disposition will you make of it?

Dr. Henry B. Horlbeck.—I move that it be adopted. Seconded by Dr. Durgin, and carried.

The Secretary.—The Executive Committee has the following report to make, with the recommendation that it be adopted:

1. A standing committee, known as the Publication Committee, shall be created by the Association as one of the regular standing committees.

2. Until otherwise ordered by the Association, such committee is hereby instructed to keep the size of the annual Transactions within the limits of four hundred pages; and to this end to conform to the several following rules:

(*a*) Make summaries of such local and other addresses as are not of permanent scientific value.

(*b*) The Chairmen of the several standing committees shall be notified by the Secretary that the reports to be presented by them shall include any material prepared by the several members of their committees, and must be in the hands of the Publication Committee not later than thirty days before the succeeding annual meeting for preliminary printing.

(*c*) Such reports shall be printed for distribution to the members on registering at the coming meeting; but no report shall be printed unless in the hands of the Publication Committee, as specified above.

(*d*) Papers to be presented at a general session of the Association shall be in the hands of the Secretary of the Association not less than twenty days before the coming meeting, and to be printed in the Transactions in full or in abstract at the discretion of the Publication Committee.

3. The Publication Committee shall consist of a Chairman, the Secretary of the Association, the Treasurer of the Association, and a member of each section of the Association, with the President of the Association *ex-officio*.

4. The Publication Committee shall formulate, if they deem it practicable, some scheme for submission to the Association at the next annual meeting, by which a public health journal may be established.

THE PRESIDENT.—What disposition will you make of this report?

DR. E. P. LACHAPELLE.—I move its adoption. Seconded by Dr. Durgin, and carried.

The Secretary read a communication from the Journeymen Plumbers' Union, and on motion it was referred to the Executive Committee.

Dr. Adolph Gehrmann, of Chicago, offered the following resolution:

Resolved, In view of the fact that a number of cities have established regular systems of medical school inspection and have been able to show a decrease in contagious diseases, and a prevention of epidemics among school children, that the American Public Health Association, recognizing the benefits of such systems, heartily approves the efforts of boards of health and of education directed towards the establishment of such systems of inspection. (Referred to the Executive Committee.)

Dr. Charles A. Lindsley, of New Haven, Connecticut, offered the following:

Resolved, That the American Public Health Association sends its hearty greetings to Dr. James F. Hibberd, of Richmond, Indiana, with its sympathy and regret that his disabilities prevent his presence with us.

DR. HENRY B. HORLBECK.—I move the adoption of the resolution. Seconded, and unanimously carried.

Miss Hester McClung, of Indianapolis, Indiana, read a paper on "Woman's Sanitary Work in Indianapolis." (See page 169.)

DISCUSSION ON THE PAPER OF MISS MCCLUNG.

DR. ARTHUR R. REYNOLDS, of Chicago.—I wish to congratulate the lady who has presented this paper, and especially that feature of

her work in reference to coöperating with everybody who is working along the same line. It too often happens that voluntary committees simply resolve themselves into scolding organizations of officials. But this is one of the most useful papers I have listened to for some time, coming as it does from a voluntary committee upon sanitary work in a city, and I wish to endorse these voluntary committees. In our work in Chicago we make a special object to encourage the organization of these associations, and I cordially invite Miss McClung to come North and help us in our efforts there.

Dr. Benjamin Lee, of Philadelphia, Pa., read the "Report of the Committee Appointed to Define what Constitutes an Epidemic." (See page 177.)

Dr. H. M. Bracken, of Minneapolis, Minnesota, followed with the "Report of the Committee on National Leper Home." (See page 180.) He also introduced the following preamble and resolution, which was referred to the Executive Committee:

WHEREAS, It is a known fact that lepers are found in Canada, the United States and Mexico; that these lepers represent immigrants of many nationalities, together with some Americans; that the exclusion of leprous immigrants by inspection is impossible; that the tendency to importation of leprous immigrants in the future will be greater even than in the past; that the danger of infection of American residents abroad and the importation of the disease through these channels is greatly increased; therefore, be it

Resolved, That this Association place itself on record as favorable to the establishment of national leprosaria, which may serve, not only as a refuge for lepers, but also as a home and hospital, making their lives tolerable so far as possible, furnishing employment to those who are able to work, and giving skilled medical care to all cases, with the intent of possibly curing some, and making the road to death less wearisome and painful than it now is to others.

Dr. Jésus Chico submitted a resolution on the same subject, as follows:

Resolved, That this Association instructs the standing committee on leper homes to put itself in communication with the national governments of the countries represented in the Association, urging upon them the necessity for the establishment of such institutions. (Referred to the Executive Committee.)

Dr. H. M. Bracken offered the following resolution, which was referred to the Executive Committee:

Resolved, That the views expressed in Dr. Alvah H. Doty's paper, entitled, "New Quarantine Methods and Changes which are Called for in Marine Sanitation," regarding the non-communicability of infectious diseases through the medium of rags and the clothing of well persons, is contrary to the experience of members of this Association.

On motion, the Association adjourned until 3 p. m.

Third Day—Afternoon Session.

The Association reassembled at 3:30 p. m., and was called to order by the President.

Dr. D. E. Salmon, of Washington, D. C., read the "Report of the Committee on Animal Diseases and Animal Food." (See page 203.)

DISCUSSION ON THE REPORT OF DR. SALMON.

Dr. H. M. Bracken, of Minneapolis, Minn.—Mr. Chairman: Dr. Salmon wrote me a short time ago asking if I had anything to report in behalf of this committee, and I replied that I had nothing prepared. However, certain cases have occurred in my own State which may be of interest. Of these I give the following brief summary:

First. Three outbreaks of hemorrhagic septicemia in cattle—hitherto, it is believed, not reported as occurring in America—have occurred in Minnesota during August and September, 1900. Of 67 animals in three herds, 37 showed symptoms of the disease, and all of these died, a mortality of 100 per cent. of the affected animals. The chief symptoms were the loss of appetite, fever, stiffness, swelling of the legs and in the submaxillary region: a black, tarry, or bloody discharge from the bowels. Bloody urine and bloody nasal discharge were present in some cases. Death occurred usually in from six to twenty-four hours after the first appearance of symptoms. The chief lesions discovered at autopsy were ecchymoses and large hemorrhagic areas in the subcutaneous connective tissues, muscles, lymph glands, and throughout all the internal organs. The cervical lymph glands, heart muscle, spleen and alimentary canal were most affected. From the nine animals on which autopsies were made the same bacillus was obtained from all tissues examined. Where the examination was made immediately after death (four cases), it was unmixed with any other organism. The bacillus was identified as belonging to the group causing chicken cholera, rabbit septicemia, rinderseuche, schweinseuche, wildseuche, buffelseuche, etc., by direct cover-slip preparations, parallel cultures in various media, and by inoculation of laboratory animals and in cattle in which the characteristic lesions were thus reproduced and from the tissues of which the inoculated bacilli were recovered in pure culture.

An attempt was made to immunize cattle by the injection of filtered, and, later, of killed cultures of the bacillus. The experiments are as yet too few, and the results not sufficiently tested to warrant conclusive statements as to the protective value of the inoculation, but it would appear that a fairly high degree of immunity has thus been reproduced.

Secondly. During the summer of 1900 a sample of milk taken from a rabid cow some five days before its examination, and thirty hours before her death, was submitted to the laboratory of the Minnesota State Board of Health for investigation. Subdural inoculations were made into three series of rabbits (eight in all). These rabbits died in 32, 14, 26, 29, 7, 28, 10, and 10 days respectively. They showed symptoms of rabies during life, and the autopsy findings confirmed the clinical observations. It is important to note that although the milk was five days old when received, the rabic virus was demonstrated to be present, contrary to all expectations.

Thirdly. From several outbreaks of malignant catarrh that have occurred in Minnesota during the past two years, an organism common to all has been isolated. This is at present still under investigation.

Fourthly. Meningitis among horses, a fatal disease, was reported to the Minnesota State Board of Health as existing in a herd. This proved to be meningitis. Of the affected horses, two were killed in the last stages of the disease for purposes of autopsy and research. From the brains of both animals and from no other organ were demonstrated in smear preparations and obtained in pure culture a large, white staphylococcus (non-pathogenic), and a small diplococcus, not to be differentiated from the diplococcus pneumoniæ (Fraenkel), except that it does not coagulate milk, and when inoculated intravenously in rabbits does not appear to multiply so abundantly in the blood, nor to prove so rapidly fatal. It was shown, however, to be capable of producing meningitis in both rabbits and guinea pigs; and judging from experiments in progress upon horses, it seems to be capable of producing similar conditions in them, although its virulence is somewhat rapidly attenuated when it is grown in the laboratory, without frequent passage through animals. Similar outbreaks have been observed recently among cattle in Minnesota, and from several of these diplococci have been isolated which are capable of producing septicemia, meningitis, and death in laboratory animals. At present, experiments are being made upon cattle with these cultures, and, it would appear, with some success in the production of similar conditions. In none of the cases reported has the diplococcus intracellularis meningitidis been found. Of course, the interesting question is, are these cultures the true diplococcus pneumoniæ? If so, are these cases comparable to pneumococcic meningitis in man, which is occasionally epidemic in type? If it is comparable, attention should be drawn to the fact that it was decidedly epidemic in the several outbreaks among cattle and horses, and the mortality was exceedingly high.

Fifthly. Two or three outbreaks of anthrax have been reported, one in horses, but the disease was not recognized as such until so demonstrated by post mortem findings. A man who helped to skin one of the dead animals died of anthrax. The disease was not recognized in this man until after death, when post mortem examination proved it to be such.

Dr. F. F. Wesbrook, of Minneapolis, Minn.—The report which has been submitted by Dr. Salmon in behalf of the committee is a most important one. I think it is time that great emphasis should be laid upon the fact that many of the diseases to which animals are subject may perhaps be due to the same microörganisms as are found to be disease-producing in man. In many cases, they have been shown to be due either to the same organism or to one which has undergone a slight change. Dr. Salmon and others think that there is some doubt as to whether the forms of bacilli found in human and animal tuberculosis are of the same variety, though they probably came from the same original stock. In certain other diseases, however, such as rabies, there does not seem to be any possible variation in the nature of the virus, and this disease typifies the importance of a thorough scientific study of diseases of both men and animals along parallel lines.

The case to which Dr. Bracken has referred where rabies virus was found in milk was one which was unexpected, coming to us as it did after a delay in transmission of some five days, during which time the milk had undergone change, having become completely soured, as it is usually termed. When we inoculated the first pair of animals, we did so believing that the rabbits would die of meningitis before rabies would have time to develop. They died, as I remember it now, at the end of thirty-two and fourteen days respectively. From the one which died at the end of fourteen days, another pair was inoculated. From the second animal of the first pair which died in thirty-two days another pair was inoculated. All four died and from one of the four, still another pair was inoculated and died. So we had a series of eight animals in which the symptoms of rabies were present, and in which, from the absence of bacterial findings and pathological lesions, we concluded that the milk contained rabies virus. All the animals died in times varying from seven to thirty-two days.

In Minnesota we have had a great many cases of rabies to investigate, and considering (1) the cases which we examined, (2) those cases which were infected by the cases investigated by us; (3) those cases infected at the same time and under the same circumstances as the cases investigated in the laboratory, and (4) the animals which infected the cases which were proven to be rabies by laboratory in-

vestigations, we have actual record of at least eighty-four cases of rabies during five years. Of course, there were only thirty-one of these in which we actually made a diagnosis in the laboratory, although there are forty-nine which have been investigated. Not only is rabies a very important disease, and one in which all state boards of health should be interested, but it is important that careful laboratory investigation be made for animal diseases in general as well as the diseases of man, because not only do we find an interrelation between the diseases of man and animals, but we find out more about human diseases when we investigate diseases in animals on account of the greater facilities for study and experimentation afforded in the latter.

Dr. Peter H. Bryce, of Toronto, Canada.—The value of Dr. Salmon's report lies in its deductions as to the danger of the milk of cows from any ordinary dairy herd being supplied in a municipal or general way to the public, without that herd having been previously and systematically tested with tuberculin. During the last five years we have had this question up before every state board and municipality, and indeed before the public through the press in its varied forms. I am particularly glad that Dr. Salmon has touched upon its real merits. We have seen from the results of experiments he has given a herd of fifty animals, perfectly healthy to all appearances, proven to be tuberculous on testing them with tuberculin. From a practical standpoint, it would seem that real danger to the public can be expressed in this manner: A cow to-day in a stable, not necessarily placed under the most favorable conditions, undergoing the pressure of high feeding in some cases and the constant strain of milking on her physical system, may manifest progressive tuberculosis, and sooner or later she passes beyond the line of safety. I have seen a herd of twenty cows (from one of our institutions) driven easily and carefully from the warm stables in winter to the slaughter-house shed and left there over night, almost all of them having reacted to the tuberculin test. The next day they were slaughtered. In these cows every degree of tuberculosis was present. Many of the animals had acute pneumonia, or an acute congestion of that area of the lungs where the tuberculosis was situated. The disease may have occurred before that night, but driving cows to the slaughter-house sheds and leaving them exposed over night was undoubtedly the exciting cause of the disease taking on an acute stage. I maintain, from a public health standpoint, that there is no recourse in the matter except to find (1) if the cows are tuberculous by the tuberculin test; (2) to remove every cow that reacts to tuberculin, as is done in Denmark and other places. The tuberculous cow should be

removed from the stable, should be prevented from giving milk, should be taken away from the general herd, fattened if possible, and killed and carefully inspected by the veterinarian, who shall determine if the carcass is safe to use for meat or not, or whether the whole carcass should be destroyed. No animal that reacts to the tuberculin test can be risked to give milk for a day longer.

Mr. F. H. Newell, Hydrographer, U. S. Geological Survey, read a paper entitled, "Investigation of Stream Pollution by the U. S. Geological Survey." (See page 212.)

DISCUSSION ON THE PAPER OF MR. NEWELL.

Dr. William C. Chapman, Toledo, Ohio.—We have been undertaking some work of this character under the auspices of the state board of health of Ohio. We have, during the past two or three years, investigated every watershed in the State of Ohio, with the exception of those along the Ohio River and Lake Erie. This work has necessitated going into details, but the investigation has paid in every way. We know the condition of every watershed in the State and have found an enormous amount of pollution. I do not suppose there is any State in the Union where pollution has been allowed to a greater extent than in Ohio. In the northwestern part of the State the waters contain a good deal of oil or petroleum. We have cardboard factories, straw-board factories, and a great many chemical works, and everything in the nature of rubbish is thrown into the river. In undertaking to prevent this pollution, we have the endorsement of the people, having received letters and delegations from all over the State asking that something be done to prevent the waters from being polluted. Our board is trying to do so by getting control of the outlet of the sewers. Any form of sewer may be built, but we control the outlet.

Frequent examinations of all rivers should be made, and the degree of pollution ascertained, for this varies with differing conditions. In our State we have found great benefit from such work if thoroughly done.

Dr. Peter H. Bryce, of Toronto, Canada.—In Canada, owing to the conditions involved in the case, the matter of pollution of streams is taken from the municipal and placed under the control of the State and Federal governments, and we have in this instance another illustration of how Federal governments are beginning to realize that there are questions which cannot be touched from the State and municipal standpoints satisfactorily, but concerning which the Federal governments in the broader interests which affect the whole nation, see is necessary to take action in the interests of the pub-

lic. Personally, I believe in a short time we shall see some action taken which will not only extend beyond the boundaries of states and interstates, but between the boundaries of Canada and America. The pollution of streams and rivers for many hundreds of miles is not only carried on to a great extent, but is gradually growing. Mr. Newell will not only confer a benefit upon this Association, but upon the two nations, Canada and America, if he will push this question until his department secures international action toward the preservation of our national streams. Personally, I thank him for his admirable paper.

Mr. C. Monjeau, of Middletown, Ohio, read a paper on "Our Domain's Most Threatening Danger." (See page 216.)

Dr. William S. Disbrow, of Newark, New Jersey, read a paper entitled, "Pages from a Sanitarian's Notebook." (See page 225.)

Mr. C. Monjeau offered the following preamble and resolution, which were referred to the Executive Committee:

WHEREAS, Disposal of waste in the sources of water from which we drink greatly increases discomfort, debility, disease and death amongst all our populations; and

WHEREAS, The disposal of such waste also tends to the impoverishment of the soil, which is the chief foundation of all our natural wealth; therefore, be it

Resolved, That this Association approves of and encourages all efforts made by governments, whether national, state or municipal, for the limitation of pollution of streams.

DR. H. M. BRACKEN.—I want to make a motion that the vote of the Association, by which the paper and recommendations of the Committee on Car Sanitation were to be printed and circulated to railway managers by the Association, be rescinded. The report and recommendations are rather extensive, and it will cost the Association a considerable amount of money to print them in that form, and they will not be as useful for the railway managers as a set of short rules, which will be embraced in a resolution, I understand, about to be offered by Dr. Hurty, and which can be sent, at very little expense, to the railway managers in North America.

DR. J. N. HURTY.—I desire to second the motion made by Dr. Bracken in the capacity of a member of the Committee on Car Sanitation. Carried.

DR. HURTY.—I now move that the report of the Committee on Car Sanitation be boiled down and the recommendations put in such shape as to be available to railway managers. Seconded and carried.

On motion, the Association adjourned until Friday morning, at 10 o'clock.

OCTOBER 26TH—FOURTH DAY—MORNING SESSION.

The Association met at 10 a. m., and was called to order by the President.

The President referred to the sudden death of Mr. Alexander H. Johnson, of Newark, New Jersey, which occurred at the Denison House the night before. He hoped the Association would extend its sympathy and condolence to the friends of the deceased, and that, so far as possible, the members of the Association would show their respect for their confrere by attending the removal of the remains from the Denison House to the train at the hour to be named.

Dr. Benjamin Lee, of Philadelphia, offered the following preamble and resolution in connection with the death of Mr. Johnson:

WHEREAS, This Association has learned with deepest regret of the sudden demise of Mr. Alexander H. Johnson, a delegate to this meeting, also to previous meetings of the Association, from the Board of Health of the city of Newark, New Jersey; therefore, be it

Resolved, That the Association tenders its regrets to the associate delegates in their sad duty to bear the remains home, also sympathizes with the board of which he has long been a valued and faithful member in the great loss which it has sustained.

After reading the resolution, Dr. Lee said: It would be appropriate to send a few words of sympathy to the members of Mr. Johnson's family, to be incorporated in that resolution.

On motion, the resolution was adopted by a rising vote.

THE PRESIDENT.—We will now listen to the report of the Executive Committee.

THE SECRETARY.—The Executive Committee reports favorably upon several additional applications for membership, with the recommendation that they be elected. (Names were read.)

MR. CROSBY GRAY.—I move that the Secretary be authorized to cast the ballot of the Association for the election of the gentlemen whose names have been read. Seconded and carried.

The Secretary then cast the ballot of the Association in accordance with the instructions, and they were declared elected.

THE SECRETARY.—The resolutions offered by Dr. H. M. Bracken and Dr. Jésus Chico, in reference to leprosy, have been considered by the Executive Committee, with the recommendation that they be adopted.

DR. LISTON H. MONTGOMERY.—I move the adoption of the resolutions as recommended by the Executive Committee. Seconded by Dr. Belknap, and carried.

THE SECRETARY.—The resolution offered by Dr. Adolph Gehrmann is referred back to the Association with the recommendation that it be adopted.

DR. ARTHUR R. REYNOLDS, of Chicago.—I move that the recommendation of the Executive Committee be concurred in. Seconded and carried.

THE SECRETARY.—The resolution offered by Mr. Monjeau is recommended by the Executive Committee for adoption.

It was moved and seconded that the recommendation of the Executive Committee be concurred in. Seconded and carried.

THE SECRETARY.—The resolution recommended for adoption in reference to the report on car sanitation is as follows:

Resolved, That the recommendations embraced in the report of the Committee on Car Sanitation be referred to Dr. J. N. Hurty and the Secretary of the Association for revision, to be published and distributed by the Secretary to all the railway companies of North America.

DR. C. H. JONES.—I move the adoption of the resolution as read. Seconded and carried.

THE SECRETARY.—The following is the report of the Executive Committee on a proposition submitted by Mr. Lomb to establish sanitary aid societies:

In keeping with the request contained in a communication to the Executive Committee from Mr. Lomb, that the Association appoint a committee to prosecute the objects contained in said communication, the Association is hereby asked to approve the appointment of a standing committee to be called the "Committee on Sanitary Aid Societies," to prosecute the work along the lines set forth in Mr. Lomb's communication.

1. To form local societies to coöperate with State and local boards of health in educating the public by distributing the prize essays of the Association and other health literature, and to form local sanitary libraries and collections of sanitary appliances, and arrange for popular lectures on sanitary subjects.

2. To employ in coöperation with State and local health boards such persons as may be deemed proper as organizers to promote the objects above referred to.

3. To urge the work of such societies upon the generosity of the public for practical financial aid in extending the work of such societies.

4. To make the arrangements, with the coöperation of Mr. Lomb, for defraying the necessary expenses of the work which Mr. Lomb

in his communication has agreed in the meantime to support without cost to the Association.

5. To this end the President recommends for appointment as Chairman, Dr. Goler, of Rochester, New York; Miss H. McClung, of Indianapolis, Indiana; Dr. E. Pelletier, of Montreal, P. Q., and Mr. Henry Lomb, of Rochester, New York.

THE SECRETARY.—The Executive Committee recommends the report to the Association for adoption.

DR. LISTON H. MONTGOMERY, of Chicago.—I move that the report be adopted. Seconded by Dr. Lindsley, and carried.

The President, on behalf of the Association, thanked Mr. Lomb for his philanthropic work.

THE SECRETARY.—The following proposition to change the Constitution of the Association has been handed in by Mr. Lomb:

Resolved, That Article III of the Constitution, which now reads, "The annual fee of membership in either class shall be $5.00," be changed to read, "The annual fee of membership in either class shall be $2.00."

DR. LISTON H. MONTGOMERY.—I would like to ask if a report has been presented at this meeting by the committee on National Legislation.

THE PRESIDENT.—No report has been presented at this meeting.

Mr. Crosby Gray, of Pittsburg, Pennsylvania, then presented the report of the Advisory Council, as follows:

REPORT OF THE ADVISORY COUNCIL.

INDIANAPOLIS, October 25, 1900.

To the President and Members of the American Public Health Association:

GENTLEMEN—Your Advisory Council begs to report that it has performed the duties required of it and submits for your approval the following nominations for officers of the Association for the ensuing term, viz.:

For President—Dr. Benjamin Lee, of Philadelphia, Pennsylvania. For First Vice-President—Mr. Rudolph Hering, of New York City. For Second Vice-President—Dr. J. N. Hurty, of Indianapolis, Indiana. For Treasurer—Dr. Henry D. Holton, of Brattleboro, Vermont. For Members of the Executive Committee—Dr. A. Walter Suiter, of Herkimer, New York; Dr. Jésus Chico, of Guanajuato, Mexico, and Mr. Crosby Gray, of Pittsburg, Pennsylvania.

Your Advisory Council also presents the city of Buffalo as the place in which to hold the next annual meeting of the Association.

Respectfully submitted,

(Signed) CROSBY GRAY, Secretary.

Dr. Liston H. Montgomery.—I move the adoption of the report of the Advisory Council as a whole, and that the recommendation that Buffalo be the next place of meeting be concurred in. Seconded by Dr. Belknap, and carried.

Mr. Crosby Gray.—If in order, Mr. President, I desire at this time to report on behalf of the Auditing Committee.

REPORT OF THE AUDITING COMMITTEE.

Your Auditing Committee begs leave to report that they have examined the accounts of the Association as kept by Dr. Henry D. Holton, Treasurer, and find them to be correct. Also that the same are kept in a very satisfactory manner.

Respectfully submitted,

(Signed) Crosby Gray.
U. O. B. Wingate.
Cressy L. Wilbur.

Indianapolis, October 25, 1900.

Dr. Arthur R. Reynolds, of Chicago.—I move that the report be adopted. Seconded by Dr. Wesbrook, and carried.

The President asked whether there was any new business to come before the Association at this time, but there was none.

Dr. R. M. Woodward, of Washington, D. C., gave "A Resumé of the Recent Foreign Work of the Marine Hospital Service." (See page 231.)

Dr. F. F. Wesbrook, of Minneapolis, Minnesota, presented a verbal "Report of the Committee on Transportation of Diseased Tissue by Mail." (See page 237.)

Dr. U. O. B. Wingate, of Milwaukee, Wisconsin, offered the following resolutions of thanks:

RESOLUTIONS OF THANKS.

There is a time in the affairs of men when it is well that they should take a retrospective view of things and consider their good fortunes, and offer thanks.

I, therefore, move you, Sir, that the most sincere thanks of this Association be extended (1) to our fellow members, Dr. J. N. Hurty, and especially Dr. F. W. Hayes, and their associates on the Local Committee of Arrangements, for the most excellent system of arrangements, unexcelled place of meeting, and their untiring attention in making our meeting most pleasant, enjoyable and profitable. (2) To Ex-President Harrison, his Excellency, the Governor of Indiana, the city officials, and all others who extended to us words of greeting and welcome. (3) To Dr. George Edenharter, his corps of assistants

and nurses for their handsome entertainment, and most excellent place of meeting for our bacteriological section. (4) To the Marion County Medical Society for their presence and many courtesies extended to us. (5) To the Commercial Club of Indianapolis for their hospitality and generous entertainment. (6) To the ladies of Indianopolis for their delightful receptions, rides and other most enjoyable entertainment, provided for our ladies, and their many courteous attentions to the members of the Association. (7) To the proprietors of Polk's Sanitary Dairy for the excellent exhibition of their methods of producing that article of food which first causes our young blood to course through our veins, and enables us to first cry out for more. (8) To the ladies and gentlemen, and especially to the company of girls from the State Soldiers' and Sailors' Orphans' Home of Knightstown, for a most enjoyable evening's musical entertainment. (9) To the press of Indianapolis for their very full, accurate and praiseworthy reports of our deliberations. (10) To the hotel managers for their devoted attention to our peace of mind and comfort. (11) To the railroads for generous and comfortable arrangements for our transportation; and last, but not least, to the weather genius of Indianapolis, for the delightful weather furnished during our stay in this city.

Dr. Liston H. Montgomery, of Chicago.—It gives me very great pleasure to heartily second the resolutions offered by Dr. Wingate. Seconded and unanimously carried.

The retiring President, Dr. Bryce, introduced his successor, Dr. Benjamin Lee, in a neat, but exceedingly appropriate, speech.

Dr. Lee thanked the Association for the distinguished honor that it had conferred upon him in a felicitous manner.

As there was no further business to come before the meeting, on motion, the Association adjourned, to meet in the city of Buffalo, in the year 1901.

SECTION OF BACTERIOLOGY AND CHEMISTRY OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.

Indianapolis, Ind., Monday, October 22, 1900.

OPENING SESSION.

Held in the Pathological Laboratory of the Central Insane Hospital.

The meeting was called to order at ten o'clock by the President of the Section, Theobald Smith, M. D. Thirty-eight members of the Section were present at the morning session.

Upon motion of Dr. F. F. Wesbrook the Section voted that it was desirable that greater freedom should be granted for transmitting diseased tissues through the mail, so as to enable culture tubes to be sent as well as swabs.

INTRODUCTORY ADDRESS OF THE CHAIRMAN, DR. THEOBALD SMITH.

The marvelous development of sanitary science during the last quarter of the nineteenth century has been due chiefly to the determination of medical science to utilize physics, chemistry and biology, those fundamental departments of experimental science, in its efforts to control disease. The expression of these efforts are the various laboratories in which the problems of preventive medicine are being analyzed with the aid of these fundamental sciences. The rise of microbiology contributed largely to the creation of these laboratories, and in microbiology the special departments of preventive inoculation and serotherapy, with which the names of Pasteur and Behring will ever remain associated, have been the chief factors in the still further expansion of laboratory facilities.

In the professional as well as the lay mind the word laboratory is usually associated with study and investigation, with the discovery of new facts, or with the rectification or overthrow of old ones. Not infrequently, however, we find that the work of the laboratory is looked upon as a kind of modernized alchemy and the results expected from it are in accord with this conception.

[The Section Publication Committee regret to say that although the relative space allotted to the proceedings of the Section is more than last year, in proportion to the total contents of the transactions, it has been necessary to omit the discussions, and to considerably abridge some of the papers sent. The rule followed was to give preference to all records of personal laboratory work, which we have been able to publish in full owing to some of the reports of committees having been held over.]

When we turn to the actual preoccupations of the laboratory devoted to sanitary science and endeavor to summarize the work undertaken there, we find different classes and grades, some approaching our ideal of laboratory occupation, others far removed from it and approaching closely executive work. Many laboratories have sprung into existence only because of a practical necessity. They are the diagnostic and analytic laboratories, serving directly the practical health officer in the control of the various agencies that tend toward disease. Laboratories devoted to investigation in sanitary science, pure and simple, are still rare. But everywhere an effort is being made to turn at least a fraction of the available energy toward the solution of problems continually arising in the routine work of bacteriological and chemical analysis, in order that, from time to time, we may give the results of this very routine work a truer or at least a more rational interpretation.

In making this effort several difficulties are encountered. In the routine work of the laboratory which deals with so much and such varied material, and which constitutes probably four-fifths of the work exacted from laboratories devoted to public health, there is opportunity given for fine inductive reasoning whose results, put to the test of experiment, may yield very valuable results. Unfortunately, however, either the time for the careful study of the accumulating statistics and facts is wanting, or else the physicians served by the laboratory neglect to furnish the desired data and render the bulk of the material on hand almost worthless.

Another difficulty arises from the close relation between the laboratory worker in sanitary science and the public. Leaving aside as well-known the frequently discouraging encroachments of politics upon the functions and functionaries of the laboratory, there is danger that the genuine scientist may be misunderstood, undervalued and eventually driven out entirely. The history of science convincingly shows that the most far-reaching discoveries are least appreciated at the time of their promulgation and the same holds true in a lesser degree for the results of investigations of lesser value. As regards some of the disadvantages of science serving the people through their representatives, I have already spoken recently, and I need not dilate upon them at this time. They are inherent in the nature of things and cannot be altered. Another problem which confronts us is the disposition of funds at our disposal in such a manner as will conduce to the best interests of the subject to which we are devoting ourselves. We must choose those lines of work, if there be any choice at all, which will yield useful results of a high order, and in this choice we may often be in conflict with our em-

ployers, because science tends to look more for the remote practice for the immediate results.

These are undoubtedly some of the considerations which have been of influence in bringing us together as a section of this Association. We realize, furthermore, that even the individual laboratory, guided and conducted along the most approved lines, cannot but gain by association with others and that the inductions reached by one laboratory may be put to the test by this association of many laboratories. We, individually, stand especially in need of encouragement, sympathy, and appreciation, without which the solitary efforts of the investigator are likely to wither or remain undeveloped. Here among men of kindred thought, that lack of appreciation of individual effort, for which we cannot blame the world at large, should be amply compensated.

I have already classified our work as consisting of investigation, and routine work created by investigation. Let us briefly examine these two kinds of work, so intimately associated with one another. Of the two I unhesitatingly put the investigation first, as the soil on which the practical work may properly develop and bear fruit. We as a body need, above all things, to emphasize the importance of research and the desirability of having proper provisions made for it. The diagnostic, analytic and executive work we know will continue to flourish and it may eventually conceal and obscure entirely the soil on which it lives, and which needs continual enriching and tilling in order that there may be fruit as well as foliage.

Let me define a little more minutely what the relation of research to practical sanitary work may be conceived to be. When we are conducting experiments in the laboratory we are studying a certain number of known or controllable interacting factors in order to learn the result of their action. The highest kind of experimental work deals with the largest number of such factors, either by eliminating them from, or bringing them into the problem. The true test of the accuracy of such experimental work is the successful repetition of it by competent men, leading to the same unequivocal results. It follows that whenever uncontrollable factors or such as escape our analysis are present, our results will vary and lack final scientific value. When, in the study of public health problems, we pass beyond the confines of the laboratory, we enter a quite different field because we are likely to encounter so many buried links in the chain of causation and so many known elements which cannot be controlled or eliminated. Hence the larger study of nature's problems must appeal to the laboratory for aid in disentangling the interwoven lines of force which enter into the making of disease. To the undefined

factors we as laboratory workers must turn for our subjects of study, ever and again. We must bring them together with those we have studied and thus by gradually enlarging our sphere of experiment, we slowly but steadily approach the real conditions, those that present themselves in the everyday life of the community and the State. The nearer we approach this limit the more applicable and hence the more useful our work becomes, either by establishing new, positive facts, or by destroying current but false beliefs.

This steadily progressive march of the analysis of phenomena of health and disease from simple to complex is, however, not always maintained. Much laboratory work is like the movement of a crab, backwards, a continual disavowal of conclusions deemed well-established for a time. The difficulty lies less in the perversity of the experimenter than in the perversity of his environment. He is forced by circumstances to take up problems not in the order in which they seem to him most accessible to solution, but in the order in which they happen to occur in the world he is serving. He is set down in a clearing in the forest with his instruments of precision and directed to survey it in its relation to landmarks to him inaccessible and invisible.

Again, the work thrust upon us through the accidents of the world at large must be attended to promptly, if at all, because the very material under observation is changing and will not suffer delay, or else because the pressure from without is too great. Hence our work is likely to be fragmentary and unfinished and to have that flavor of the practical which does not commend itself to more academically placed brethren. However, work done with some practical end in view may be fully as scientific in its spirit, method and outcome, and as valuable to the progress of science as any of the traditional work of college or university. Whoever unearths a few consecutive links of the phenomena of cause and effect is entitled to the world's gratitude, be these links near one end of the chain or the other. In all things, nature has applied the same principles and displayed the same degree of ingenuity, and where can it be said has she exercised more of it than in the ever-shifting battle-ground of the infectious diseases, where the cunning of two different orders of living beings is exerted not only to protect themselves, but to find a breach in the other's armor?

The peculiar situation of the public health laboratory as I have outlined it should make the investigator very cautious concerning the conclusions he may publish and maintain. Conservatism is of the utmost importance, since all new facts applied to every-day life tend to disarrange to a greater or less degree existing relations. It

is always safe to underestimate our inferences, and safer still to draw conclusions only when all doubts are silent. The publication of experiments need not be deferred even if they do not point to a definite outcome, since they may help and stimulate others to carry the proof farther. In our relation to those whose duty it is to formulate and enforce rules for the protection of the public health and who depend upon us for sound, unbiased advice at critical times, we should always clearly state the limitations governing our work. If the conditions of the problem presented conform to those in our experiment, then we can predict a certain result, but if there are additional variable factors which we have not included in our study, then our information cannot be final. Just here the opportunity for research on the part of the practical sanitarian enters. By unearthing and defining the new and variable elements in the larger practical problem and transferring them to the laboratory for consideration his work may become of inestimable value to sanitary science.

The need for continued investigation both within and without the laboratory is thus only too obvious, and before leaving this theme I yield to the temptation of illustrating it from the general problem of the etiology of infectious diseases to which I have given more or less attention. This problem demands the services of bacteriology, or more broadly, of microbiology and of pathology. In the domain of bacteriology we are just emerging from the rather one-sided and superficial study of bacteria and their gross physiological characters and beginning to realize that the character of an infectious disease is due to the host as well as to the parasite, and that the interaction of the two organizations causes modifications in both. We are thus confronted by conditions whose complexity was not anticipated ten or fifteen years ago. We have learned among other things to recognize quite a host of microörganisms which have the power to produce pathological conditions, but which are evidently secondary to other agencies. It has been the custom to denominate as secondary those bacteria which follow in the wake of other pathogenic forms and which lead to various complications of the primary disease, and which are frequently the immediate cause of death. But there is evidence that perhaps all pathogenic microbes are in a sense secondary, in so far as their invasion is permitted only by morbid conditions largely undefinable at present. Some of these may resolve themselves into the effects of other microörganisms not at present known or under suspicion; others may be due to changes in our food and environment influencing the physiological mechanisms. Our investigations must therefore go back of the specific microörganisms to more primary agencies or conditions, for prevention begins as far

back as the scientific analysis of pathogenic influences can reach. In the meantime applied hygiene must try to suppress with every possible means those causes actually in sight, be they primary or secondary, in order to interrupt the chain of agencies leading to disease. The practical benefit to be derived from the most profound study of etiology resides in the fact that the farther we go back of the immediate causes of disease, the more easily and economically can they be controlled, and the more weapons we are able to furnish the sanitarian from which to choose in his combat with disease. Among the problems which are today clamoring for attention, I may mention all those that group themselves about the conception of immunity, the toxins, antitoxins, and bactericidal forces, the variations of pathogenic bacteria, and the interrelation of human and animal infections. There is ample opportunity for both bacteriologist and pathologist to exercise in this restricted field the highest degree of scientific acumen and sagacity in the application of physical, chemical and biological methods to the study of disease.

Passing to the routine tasks of the public health laboratory, we have before us the problem of methods and procedures to which this section has for the time being committed itself. We wish to learn how we can most thoroughly and successfully do these tasks and at the same time force them to disgorge, as it were, facts new to science; how we can so homogenize our processes that those valuable inductions to which I have referred can be reached by a utilization of material from all laboratories, we also wish to learn how we can congeal our methods and yet have them alive and progressive.

To the investigator methods are ever changing with the objects of research because the method to him is simply a path to the result. Whenever the latter has been attained, the path is abandoned and another laid out towards some other goal. The history of science is a witness to the fact that the most commanding geniuses have always created new methods rather than use those of their contemporaries or predecessors. The reason is obvious. Every discovery of a new fact demands a new method, or at least a profound modification of existing ones. Discoveries are now and then accidental and may rest on errors in the application of existing methods. From this point of view methods and procedures are of very high significance in science. They are in effect the embodiment of the various factors which determine the result and they approach the nearer to the actual processes of nature, the greater the number of controllable elements which enter into the problem. With the attainment of certain results and their practical application for the differentiation and classification of facts there comes the necessity for the simplifying and perfecting

of methods for the use of that large and growing army of workers engaged upon the diagnostic and analytic tasks of our laboratories upon whose industry and faithfulness we must depend for the routine performance of work demanded by the public health. They must follow the beaten path and we must make it as short and direct as possible.

The essential value of such methods from which uncertain factors have been largely eliminated resides in the accumulation of data of more or less uniform character. These may become of great value in leading to new theories and inferences when the numerous data are subjected to careful comparative study. To demonstrate the truth of the new theories evolved, new methods may be needed. We may illustrate our statement by drawing upon some simple and familiar facts obtainable by a study of the fermentative capacities of bacteria. The examination of a large series of closely related colon forms has shown that those which fail to act upon lactose and saccharose belong to the distinctly pathogenic or invasive forms. The inference which may be drawn is that, in the acquisition of parasitic habits the fermentative action upon these sugars is not brought into play and the function gradually lost. To prove this inference it would be necessary to modify a colon form by passages through animals. For only by such an experiment can we effectually banish certain other inferences which rise up to cloud our convictions, such as the view that *B. coli* is not the direct ancestor of the pathogenic group, but that both are derivatives of an ancestral form and that the existing colon forms are no longer modifiable into the invasive types. Here a new class of experiments should enter with new methods to test the inferences drawn from the use of the fermentation tube by the horizontal application of a certain method and a summation of the results. Unless we are content to have our science build itself up on hypotheses or theories until it becomes top heavy, we must continually devise new experiments to test them. The relative merit of the statistical and the experimental method in disclosing truths of a higher order need not detain us here. They are both essential and they supplement one another.

In the formulation of methods for general use we must continually bear in mind certain tendencies which are likely to take possession of us. In the first place, we must be charitable towards work done with other methods, although, it must be confessed, it is often difficult to steer between the rejection of such results, occasionally embodying the germ of new and highly original facts and the acceptance of work done slovenly, and in defiance of accredited methods. The so-called schools in pure and applied science are largely built upon methods of

work. Some fifteen years ago we were familiar with the Pasteur and the Koch school of bacteriology, now things of the past, because the respective technique has been made universal. All that can be said of such schools is that their value is temporary and their continued recognition harmful.

Crystallized methods are thus both a safeguard and a danger. They guide us and make our results homogeneous. They may also petrify our modes of thought if we too slavishly adhere to them. We must, in short, bear in mind that all codification of procedures and methods is too much like the fencing in of our ignorance. While the thought that it has been well secured and that it cannot escape may be of great comfort and a means of relaxation to us, it may not advance science or increase its utility. Lastly, codified methods may stifle opportunity for discovery by being too top heavy and hence by occupying too much time. The truly sagacious enquirer, however, soon knows where to throw out ballast so as not to encumber his journey too much.

In the choice of methods we should, therefore, clearly define to ourselves our purpose. If we are seeking the solution of new problems we must create new ways and means. If we are making collective investigations to secure and broaden the basis of accepted facts, our technique must be both uniform and detailed. But the duty of this laboratory section consists not only in codifying methods but also in continually examining and testing new devices and processes. Methods will forever remain in a state of flux, and all that we can do is to see that the flow is uniform and rapid and that the assimilation or rejection of what is encountered on the way fairly complete.

TABLE I.

TYPE.	NAME.	INVESTIGATOR.	SOURCE.	Morphology.				BIOLOGY. Cultural Features.								BIOLOGY. Biochemical Features.																			Pathogeneity. Mice.
				Bacillus.	Diameter Greater than 1 Mikron.	Motile.	Spores.	Broth. Scum.	Broth. Turbidity.	Agar. Dull.	Agar. Wrinkled.	Gelatin Plate. Characteristic Appearance.	Potato. Visible.	Potato. Luxuriant.	Fermentation Tube. Growth in Closed Arm.	Growth at Body Temperature.	Facultative Anærobe.	Affected by Range of Reaction.	Liquefaction. Gelatine.	Liquefaction. Casein.	Liquefaction. Blood Serum.	Gas Produced. Dextrose.	Gas Produced. Saccharose.	Gas Produced. Lactose.	Nitrites.	Indol.	Milk. Acidity.	Milk. Coagulation	Fæcal Odor.	Agar. Chromogenesis.	Agar. Fluorescence.	Most Favorable Reaction.	Intraperitoneal Inoculation.
Colon A.....	B. Coli Com.....	Escherich	Normal Intestine ...	+	—	+	+	+	+	—	—	—	+	+	+	+	+	+	—	—	—	+	+	+	+	+	+	+	—	—	0	+
Colon B.....	B. Coli Com.....	(Ford)	Stomach Pernic. Anaem.	+	—	+	—	—	+	—	—	—	+	+	+	+	+	+	—	—	—	+	+	+	—	+	+	+	+	+	+	+1.5	-
	B. Coli Com.....	(Harris)	..... ?	+	—	+	—	—	+	—	—	—	+	+	+	+	+	+	—	—	—	+	+	+	—	+	+	+	+	—	—	1.5	—
	Lactis Aerogenes	Escherich	Normal Duodenum..	+	—	—	—	+	+	—	—	—	+	+	+	+	+	+	—	—	—	+	—	+	—	—	+	+	—	—	—	?	—
Colon C.....	B. Coli Com.....	(McCrae)	Fæces	+	—	+	—	+	+	—	—	—	+	+	+	+	+	+	—	—	—	+	—	+	—	+	+	+	+	—	—	+1.5	+
Colon D.....	B. Coli Com.....	(Ford)	Typhoid Spleen.....	+	—	+	—	—	+	—	—	—	+	+	+	+	+	+	—	—	—	+	—	+	—	+	+	+	+	—	—	+	+
Colon E. ...	B. Coli Com.....	(Ford)	Kidney Rabbit	+	—	+	—	—	+	—	—	—	+	+	+	+	+	+	—	—	—	+	+	—	—	—	+	+	—	—	—	+1.5	—
Paracolon A.	Paracolon Cushing	Cushing	Abscess Rib ..	+	—	+	—	—	+	—	—	—	+	—	+	+	+	+	—	—	—	+	—	—	—	+	—	—	+	—	—		—
	Paracolon Gwynn	Gwynn	Cervical Abscess.....	+	—	+	—	—	+	—	—	—	+	+	+	+	+	+	—	?	?	+	—	—	?	+	—	—	?	—	—	?	?
	B. Burley..... ..	..... ?	..... ?	+	—	+	—	—	+	—	—	—	—	—	+	+	+	+	—	—	—	+	?	?	—	—	—	—	—	—	—	+	+
	B. Hatton	Durham	..... ?	+	—	+	—	—	—	—	—	—	+	—	+	+	+	+	—	—	—	+	—	—	—	+	—		—	—	—	+	+
	B. Morbif. Bovis	Basenau	..... ?	+	—	+	—	—	+	—	—	—	—	—	+	+	+	+	—	—	—	+	—	—	—	+	—	+	—	—	—	0	+
	Icteroides IV.....	Sanarelli	Yellow Fever Lesions.....	+	—	+	—	—	+	—	—	—	+	+	+	+	+	+	—	—	—	+	—	—	—	—	—	—	+	—	—	0	+
	Icteroides II	Reed.....	Yellow Fever Lesions..	+	—	+	—	—	+	—	—	—	+	+	+	+	+	+	—	—	—	+	—	—	—	—	—		—	—	—	0	+
Paracolon B.	Paracolon B.....	(Ford)	Liver Rabbit .	+	—	-	—	—	+	—	—	—	+	+	+	+	+	+	—	—	—	+	—	—	—	—	—	—	—	—	—	1.5	+
	B. Cholera Suis..	.....	.....	+	—	+	—	—	+	—	—	+	—	—	+	+	+	+	—	—	—	+	—	—	—	—	—	+	+	—	—	0	+
Cloacae.....	B. Cloacae	Jordon	Sewage.....	+	—	+	—	+	+	—	—	—	+	+	+	+	+	+	+	+	+	+	?	?	+		?	+	+	—	—	?	+
Paracolon C.	Paracolon C	(Ford)	Liver Rabbit .	+	—	+	—	—	+	—	—	—	+	—	—	+	+	+	—	—	—	—	?	?	—	—	—	—	—	—	—	?	?
B. Typhosus.	B. Typhosus.....	Eberth	Typhoid Lesions	+	—	+	—	—	+	—	—	—	—	—	+	+	+	+	—	—	—	—	—	—	—	—	—		—	—	—	+	—
Paracolon D.	Paracolon D	(Ford)	Typhoid Spleen.. ...	+	—	+	—	—	+	—	—	—	—	—	—	+	+	+	+	—	—	—	—	—	—	—	—	+	—	—	—	—	

VARIETIES OF COLON BACILLI ISOLATED FROM MAN AND ANIMALS.

By WM. W. FORD, M. D., D. H. P.

(From the Molson Pathological Laboratory, McGill University.)

The recent work of Fuller and Johnson, in which they classified the water bacteria found in the Ohio River, according to a large number of constant characters—using those reactions which were recommended by the Bacteriological Section of the American Public Health Association, and eliminating any tests which failed to give 100 per cent. of constancy, has suggested to the writer the advisability of adopting a somewhat similar classification in the descriptions of members of the colon-typhoid series. Therefore, all of the organisms which were in the laboratory were subjected to the treatment recommended by Fuller and Johnson, namely, they were grown in broth three days, in gelatine plates three days and on slant agar three days, after which time the various culture media were seeded.

By such a means an organism is forced to assume a constant laboratory character, parallel in a way with the constant character it may have in its natural habitat. We thus avoid in our description of its biology that period in the life history of any bacterium when it possesses inconstant features, as is the case for instance, immediately after isolation from the intestines.

The various members of this series have been classified as far as possible in accordance with these constant characters, and the result of this classification is the chart which is appended to this paper.

While the different types described seem to be separated from each other by only a few characters, yet each type is represented by a number of corresponding cultures and the organisms of one type never assume the properties of other types.

In order to assure completeness in this table of bacteria the reactions of B. Typhosus were estimated at the same time and the reactions of B. Lactis ærogenes and B. Cloacæ, are taken directly from the tables of Fuller and Johnson. The fermenting properties of certain members of the intermediate group as well have been adopted from Cushing's paper as some of the cultures used in Montreal died out.

The typical bacillus coli communis originally described by Escherich is a motile bacillus without the property of forming spores, whose diameter is less than 1 micromillimeter.

It forms a scum on broth, with production of a turbidity, is not dull or wrinkled on agar, fails to show a characteristic appearance on gelatine plates. It causes an abundant growth on potato, grows in the closed arm of the fermentation tube, grows at body temperature, grows as an ærobe, and is affected by the range of the reaction of the media.

It does not liquefy gelatin casein or blood serum; it produces gas with dextrose, saccharose and lactose; it produces nitrites, indol and a fæcal odor, produces acid and coagulates milk. On agar it is not chromogenic or fluorescent, and usually prefers an agar which is slightly acid in reaction. It is pathogenic for mice in intraperitoneal inoculation of a 1 cc. dose of a 24 hour fluid culture.

The estimation of these reactions while apparently simple may at times be very difficult of attainment, as the colon when first isolated from the body does not show a characteristic biology. Its morphology especially is subject to the greatest variation. It may appear either as a simple rod-shaped bacillus, as straight bacilli many times the length of the typical form, maintaining the same diameter throughout, or as a diplococcoid body, as has been pointed out by Adami. The latter form, according to Adami, is more or less an attempt on the part of the organism to form resistant bodies, and is the condition in which the organism appears in the tissues.

Cultures from internal organs which on section show no bacilli but only a profusion of coccoid and diplococcoid bodies, from secretions like ascitic fluid, which show the same bodies, will invariably grow out after a lapse of 24 hours into a typical colon bacillus. The same may be said of the long straight forms which are often encountered in the fluid from the gall bladder. These, like the diplococcoid bodies, invariably produce bacilli differing in no particular from the typical colon in morphology and belonging to some pure type of this species.

The question of motility has been disputed by different observers and the colon has been said at times to possess, and at other times not to possess this character. Examined in a 24 hour fluid culture, the organisms classed as colon or allied forms, have never failed to show active motility. The velocity of the colon is not as great as that of many motile bacilli, but its appearance is unquestionable. Despite the fact that Theobald Smith, in determining the position of an organism which in its cultural features corresponded to the hog cholera bacillus, but which lacked motility, unhesitatingly placed it with the hog cholera group, according to Fuller and Johnson permanent absence of motility must be considered as a radical departure from the pure colon type.

The production of gas in carbohydrates must be studied only with sugars which have been sterilized in the steam sterilizer—for the pressure and temperature of the autoclave are sufficient to break down saccharose and lactose into the simpler dextrose and by-products. It is essential in studying the colon that these three sugars be used, as certain varieties ferment one and not the others; only the typical colon and its near allies fermenting all three carbohydrates.

The test for indol has never yielded satisfactory results. Only broth which has been rendered free from sugar by the previous growth in it of a fermenting bacillus can be utilized for this purpose, for it has been shown by Theobald Smith that a small amount of carbohydrate will inhibit the formation of indol. Even with this precaution the different varieties of colon seem to produce this substance in a most unreliable fashion, some forms only producing it when fresh from the intestine. Probably the only possible way of estimating this character with accuracy will be to utilize large quantities of sugar-free broth, which after an incubation of 15-20 days, may be distilled and the distillate tested for indol and by-products. In this way Dr. Bruere of the Royal Victoria Hospital is at present endeavoring to ascertain the differences between the various paracolibacillary forms.

The perception of a fæcal odor similarly to the test for indol does not give always that reliability which is desirable in the estimation of constant characters. Like all tests which depend on the sense perception of smell which differs so largely in different individuals, the fæcal odor can only be considered as a doubtful reaction.

The production of nitrites may be estimated in connection with the routine tests for indol by sulphuric acid, when one uses a broth which does not itself contain traces of nitrites.

A more reliable method, however, since ordinary broth or sugar-free broth contains this substance, is to utilize Dunham's solution made from a peptone free from nitrites, or the so-called nitrite broth containing a small per cent. of potassium nitrate and a little peptone.

In either case the organism by its growth may directly reduce the nitrates to the nitrite condition, or breaking up the peptone oxidize the nascent nitrogen to a nitrite. The test may preferably be made with nitrate broth, using Dunham's solution as a control.

The inoculation of the colon bacillus and its allies on agar tubes, the reaction of which varied between an acidity of 15 and an alkalinity of 6.0, revealed a fairly constant law in regard to the profusion of growth. The colon grows most abundantly on agar which is

slightly acid or of an acidity of 1.5 per cent., the growth on neutral agar being as a rule slightly less.

As one passes from the neutral to the alkaline agars the abundance of growth rapidly diminishes—an agar of an alkalinity of 1.5 giving a less visible growth than the neutral, 3.0 agar only a faint growth, 4.5 agar only traces, while an agar of an alkalinity of 6.0 inhibits the growth entirely.

All of the organisms belonging to the colon, typhoid or intermediate groups which we have worked with, may be divided into a certain number of types which are represented on the chart. For convenience of description only, they have been arranged in certain orders, not that they necessarily have this place in nature.

The different varieties of pure colon, if we may use the phrase, have been divided into Colon A., B., C., D., and E.

Under Colon A., have been included all those forms which correspond to Fuller and Johnson's table of characters. These colons ferment all the sugars, produce indol, nitrites and a fæcal odor; grow luxuriantly on potato and produce a scum on broth. They are pathogenic in all cases to mice by intraperitoneal inoculation. As a rule they grow most luxuriantly on neutral agar.

The second type, named Colon B., differs from the first in never producing a pellicle on broth. It produces indol and a fæcal odor, grows most luxuriantly on agar of an acidity of 1.5 per cent. and is pathogenic. While the characters separating this type from the previous one seem so slight as not worthy of making a separate class, yet the confusion of statements in the literature about the colon at times producing a definite scum on broth, and at other times not, and the experience in the Molson laboratory that the form of organism which produced a scum always did so, and the form not producing such a scum invariably failed to do so, has led us to formulate these two types. In fact, the majority of bacilli which were encountered in Montreal correspond to type B. rather than to type A., but for uniformity of description Fuller and Johnson's colon has been considered the model form.

Between Colon B. and the next type C. may be most conveniently placed those forms which have lost their pathogenicity. This doubtless may occur with any variety of colon under unfavorable conditions of growth and cannot be said to constitute a different variety. This loss in pathogenicity was encountered in only one form, a variety obtained from Dr. Harris in Baltimore. All other varieties of colon, with one execption to be mentioned later on, were pathogenic in intraperitoneal inoculations.

If we combine loss of pathogenicity with loss of motility we have a form which is identical with B. Lactis ærogenes of Escherich, not producing indol or a fæcal odor, but agreeing in its other reactions with B. Coli Communis.

As has been indicated above these differences should suffice to make this form a distinct variety, separated as it is by constant unvarying characters.

Under Colon C., have been included those forms which agree with the typical colon in most of its reactions, but differ in the fermentation of the sugars. Dextrose and lactose are fermented, saccharose never. A scum is produced on broth, indol is formed and a fæcal odor exudes from the cultures. This variety as well has been encountered a number of times.

Colon D. includes bacilli similar in all respects to the preceding, in respect of the fermentation of lactose and dextrose, but like Colon B. the corresponding first derivative from Colon A., it fails to produce a definite pellicle on broth.

A further derivative of the pure colon is that form which produces fermentation with dextrose and saccharose, but not with lactose. It has been described frequently by earlier writers and is a well recognized variety of B. Coli Communis. In our case it was not pathogenic, did not produce indol, nitrites, or a fæcal odor, but otherwise was identical with the prototype Colon A.

As we pass from these varieties of paracolibacillary organisms which ferment two of the three sugars, to those which ferment but one, namely dextrose, we enter upon the intermediate group of Gærtner or the Hog Cholera group. The first form which is encountered here, which goes by the name of paracolon is the organism of Cushing called by him Bacillus O., or by other authorities Paracolon Cushing. It may well be called Paracolon A., and may serve as the introduction to the intermediate group.

Isolated by Cushing from an abscess over a rib, this form possesses characters intermediate between typhoid and colon. It grows very slowly on potato, giving a visible growth only after several days' incubation; it ferments dextrose, not lactose and saccharose; it does not coagulate milk or produce acidity; it produces indol after the lapse of a number of days, has a fæcal odor and is pathogenic to mice.

With the paracolon of Cushing may be grouped B. Burley, B. Variety Hatton of Durham, and B. Morbificans Bovis of Basenau, which isolated from far different sources by different observers agree in so many details as to be placed by Durham in this intermediate group, all the members of which are pathogenic.

Included in the same group are the so-called "icteroides" isolated by Sanarelli and Reed from yellow fever patients. These bacteria differ from the preceding only in the formation of a moist luxuriant growth on potato, fermenting only one sugar—dextrose—as the other forms do.

Associated with these icteroides we have placed a further variety which has been called Paracolon B. It was obtained from the liver of a healthy rabbit and was originally considered to be a simple colon derivative. It agrees in all cultural features with the organisms of Reed and Sanarelli, and without doubt belongs to this group —failing to ferment lactose and saccharose and failing to produce acidity in or coagulate milk.

Among the intermediate members of this group should doubtless be included paracolons isolated by Widal and Gwynn. The description given by Widal is too meagre to furnish a means of classification, but the work of Gwynn and of Cushing on the paracolon isolated by the former shows clearly the place this bacillus should occupy. From Gwynn's description has been compiled the life history of this bacillus and it has in this way been included in the chart.

It is actively motile, grows on bouillon as a distinct cloud, not forming a pellicle, acidifies milk faintly, without coagulating, gives a luxuriant growth on potato and does not liquefy gelatin. It ferments dextrose, not lactose or saccharose, and it does not produce indol.

The next member of this group is the B. Cholera Suis, which is identical with the others in the main characters. It has been placed last in this group and has been associated with the B. Cloacæ, which is positive in liquefying gelatin, casein and blood serum. The latter produces indol, nitrites and a fæcal odor, has a luxuriant growth on potato and produces a scum on broth.

Naturally it does not belong to this intermediate group and has only been mentioned here for purposes of comparison with B. Cholera Suis.

Intermediate between colon and typhoid but approaching more to the type of the Eberth's bacillus, are a number of little known and little studied forms of paratyphoid. The only organism which we have encountered which seems to belong to this group is one which we have provisionally named Paracolon C.

It was obtained from the liver of a healthy rabbit and is evidently allied more to typhoid than to colon, forming a faint growth on potato, but not producing indol or a fæcal odor, not coagulating or acidifying milk, nor fermenting the carbohydrates.

It seems to be closely related to the form isolated by Flexner from cases of dysentery, in association with the amœba coli, agreeing with

it in its fundamental characteristics. It, like Flexner's organism, should doubtless be classified as a para-typhoid.

It corresponds as far as can be told with other varieties of intestinal bacteria described heretofore, especially the non-fermenting varieties of Widal and Gilbert.

The B. Typhosus stands next for purposes of comparison. This organism is too well known to need any further words, but its place in this chart is justified by reference to its invisible growth on potato, its failure to produce gas or to coagulate milk and its being non-pathogenic.

The next organism in our series of paracolibacillary forms, which is named Paracolon D., has been isolated in two instances, from the stomach of a healthy man in one case and again from a typhoid spleen. It is the furthest removed from both the colon and the typhoid type and represents a variation from the colon in not fermenting any sugar, not producing nitrites, indol, or a fæcal odor, in not growing on potato, not being pathogenic, and in liquefying gelatin. In morphology it is a fine short bacillus, bearly distinguishable from a micrococcus, and its especial characteristic is the growth on slightly alkaline sugar as a faint film which, after a lapse of forty-eight hours, seems indistinguishable from the substratum of medium.

While it may be identical with other intestinal bacteria described before, yet we have not come upon any similar organisms recorded in the literature and we are therefore inclined t look upon it as a new species. It has been named provisionally Paracolon D.

From the study of the organisms given in the chart, one is convinced that while a proper biological classification of bacteria is still as far as ever from attainment, yet much may be done by this graphic method in illustrating the relations which the different intestinal bacteria bear to each other. With one or two exceptions the bacteria described here are well known forms which have already been reported.

By means of such a table of constant characters it becomes possible, however, to fill in the gaps of our knowledge concerning intestinal bacteria, and adopting standard reactions in our descriptions by means of a comparison of results in different laboratories, to arrive at a more and more complete knowledge of the colon and its allies, the paracolibacillary organisms.

I wish to express my thanks to Dr. Adami of Montreal, under whose supervision the work reported in this paper has been carried out, and to Dr. Harris of Baltimore, who has furnished me with a number of cultures from the Johns Hopkins Pathological Laboratory.

SOME OBSERVATIONS ON METHODS FOR THE DETECTION OF B. COLI COMMUNIS IN WATER.

By E. E. IRONS, Chicago.

In the course of an extended examination of polluted river waters for the Sanitary District of Chicago, a number of methods for the detection of B. coli communis have been regularly employed, and still others experimented with. Four methods have been especially studied: (1) the dextrose fermentation tube, (2) the lactose fermentation tube, (3) the carbol-broth method, (4) the lactose plate.

For the dextrose and lactose fermentation tubes, broth was prepared from fresh meat from which the muscle-sugar had been extracted by Smith's method. One per cent. of sugar was then added to the broth. The initial reaction was made neutral to phenolphthalein, experiments having shown no appreciable difference between the results with this reaction and others slightly more acid. Experiments likewise showed no material difference between tubes containing 1 per cent. and 2 per cent. of sugar. Other factors of variation, over which we have no control, probably outweigh these smaller differences. The cultures were incubated at 38° C. for 48 hours, gas readings being taken after 24 hours and 48 hours. No material changes were observed if the incubation period was prolonged to three days. Tubes showing gas formation were removed from the thermostat, cooled to the temperature of the room and the absorption of CO_2 determined by the addition of a 2 per cent. solution of NaOH. Sometimes, particularly in the larger tubes, the absorption was incomplete after the first addition of NaOH, and more had to be added.

Carbol-broth was made by adding 1 c.c. of a 1 per cent. solution of carbolic acid in sterile water to tubes containing 9 c.c. of sterile common broth[1]. From such tubes, incubated 24 hours at 38° C., lactose plates were inoculated and placed in the thermostat for 24 hours. Fish cultures from resulting red colonies were made, and the growth reactions determined in milk, gelatin, potato, sugar-free broth for indol, and the dextrose fermentation tube.

Litmus-lactose-agar was prepared by adding to sugar-free agar, of a reaction 5 alkaline to phenolphthalein, 1 per cent. lactose and enough blue litmus solution to give a clear blue color. Plating with the water direct was carried on in the usual manner. The plates were incubated at 38° C. for 24 hours.

[1] Except where otherwise stated, media were prepared according to the "Procedures Recommended for the Study of Bacteria." Journ. Amer. Pub. Health Association., Jan., 1898

THE FERMENTATION TUBE.

Approximately 1100 determinations were made by the fermentation tube with dextrose and lactose. Lactose was used in hope that the trouble caused by B. cloacæ might be avoided, since B. cloacæ ferments lactose very slowly as compared with B. coli, but as will appear presently this expectation was not justified. The results obtained with dextrose broth seem to warrant the assumption that when the gas formula shows a marked excess of H over CO_2 (i. e., approximately a 2-1 formula) B. coli is generally present. A number of tubes giving such a formula were examined, and only rarely did we fail to isolate an organism closely approximating typical B. coli. Moreover when failure to isolate B. coli did occur, B. coli may still have been present, but overlooked among the large number of other colonies on the plate. Experiments with artificially mixed cultures of B. coli and B. cloacæ, freshly isolated from water, showed sometimes a coli, sometimes a cloacæ gas formula, but in the majority of cases B. coli gained the upper hand and an excess of H appeared in the tubes. When the fermentation tube is used for highly polluted waters, it occasionally happens that there is little or no formation of gas even though B. coli is probably present as shown by the typical gas formula in higher dilutions of the same water. This difficulty, however, may be obviated in large measure by using several dilutions where the pollution of the water is not approximately known.

The following table (Table A) gives the totals obtained in a series of 59 determinations in duplicate with dextrose and lactose broth. Each determination with dextrose was made simultaneously with the same dilution of the water as the corresponding lactose determination, and both were kept as nearly as possible under identical conditions. Both polluted and comparatively pure river waters were employed in this series.

TABLE A.

Dextrose Fermentation Tube.			Lactose Fermentation Tube.		
+	—	?	+	—	?
27	19	13	21	29	9

\+ = total gas more than 20%; formula showing marked excess of H.
— = no gas; gas less than 10%.
? = total gas 10%-20%; total gas more than 20% with formula showing excess of CO_2.

The table shows that for general work dextrose is to be preferred to lactose. This is true for both polluted and unpolluted waters as is shown if the results obtained from the two classes of waters are tabulated separately. It is of course recognized that the B. enteritidis group ferments dextrose, but not lactose. However, germs of this class are probably rare in river waters.

THE CARBOL-BROTH METHOD.

Several hundred determinations were made by the use of carbol-broth followed by the lactose plate. The following table (Table B) shows the totals obtained in a series of duplicate tests made to ascertain the comparative value of the dextrose fermentation tube and the carbol-broth method on both polluted and relatively unpolluted river waters.

TABLE B.

	Dextrose Fermentation Tube.			Carbol-broth Method.		
	+	—	?	+	—	?
Polluted Waters.....	33	31	5	38	30	1
Relatively Unpolluted Waters.....	56	38	25	37	61	21

Dextrose fermentation tube: +, —, ?, as in Table A.

Carbol-broth method:

+ = red colonies on the lactose plate, which give the typical reactions of B. coli in (1) milk, (2) gelatine, (3) potato, (4) sugar-free broth for indol, (5) the dextrose fermentation tube.

— = no red colonies; red colonies do not give an excess of H in the dextrose fermentation tube, or they fail in the other reactions.

? = red colonies fail to give one or two of the first four typical reactions above.

From the results in Table B, it is apparent that the carbol-broth method gives a larger number of positive determinations for B. coli than does the dextrose fermentation tube, when polluted waters are tested. On the other hand, with relatively pure waters, the dextrose tube is shown to be a much more delicate test than the carbol-broth method.

THE LACTOSE PLATE.

Comparative experiments on the use of the lactose plate made in series with the dextrose fermentation tube as a control, resulted rather unfavorably for this method. In many cases the plates made with lactose agar having a reaction of 5 alkaline to phenolphthalein,

failed to show any red colonies, when the dextrose tube gave a 2-1 gas formula. When the alkalinity was reduced to 5 acid to phenolphthalein, many red colonies appeared which gave either an inverted gas formula, or, more often, no gas at all with dextrose, although the control dextrose tube showed the probable presence of B. coli.

In polluted waters where B. coli is present together with other slightly acid forming species, the excess of the acid of B. coli may so far neutralize the alkalinity of the medium that the weaker acid producers appear as red colonies. Hence there is a possibility of error in assuming that the number of red colonies on a plate indicates the presence of a proportionate amount of B. coli.

In general, results show that where the waters to be examined are much polluted, or where the amount of B. coli is small and the colony count large, the lactose plate for plating water direct is inferior to the dextrose fermentation tube.

Other methods were tried but they proved to be either impracticable, or no improvement on the foregoing. Elsner's medium was experimented with, but it failed to give as good results as lactose agar, besides being more difficult of preparation. The use of carbol-iodide-broth suggested itself as a possible means of differentiating the troublesome alkali producers which survive the preliminary incubation in carbol-broth. The iodide (1 per cent. KI) proved to add nothing appreciable to the inhibitive power of the carbolic acid. Experiments with various strengths of carbolic acid showed a dilution of 1-1000 to be the most advantageous.

The results of the work of which the foregoing experiments formed a part, suggest the following points:

1. When the dextrose tube method yields approximately 33 per cent. of CO_2, B. coli is almost invariably present.

2. For the direct inoculation of water, the dextrose fermentation tube is preferable to the lactose tube.

3. For polluted waters, incubation in carbol-broth followed by the lactose plate gives better results than the dextrose tube, while for relatively pure waters, the dextrose tube appears to be the more delicate.

4. When highly polluted waters are under examination, the lactose plate for the direct inoculation of water is less successful than either carbol-broth or the dextrose tube. In our experience this method has given the best results when applied to waters containing a small number of other bacteria in proportion to the amount of B. coli present.

I am indebted to Professor E. O. Jordan, under whose direction this work was done, for many helpful suggestions and criticisms.

VARIATIONS OF THE COLON BACILLUS IN RELATION TO PUBLIC HEALTH.

By Dr. J. E. MONJARÁS, San Luis Potosi, Mexico.

The following conclusions were arrived at:

1. The colon bacillus is found normally as a saprophyte in the human organism.

2. It is found alone or associated in the following infections: Tonsillitis, cholera nostias, cholera infantum, appendicitis, abscess of the liver, urinary infections, nephritis, general septicæmia, puerperal fever, salpingitis, osteomyelitis, meningitis.

3. It may become virulent owing to digestive disturbances in the host, and give rise to a series of pathologic disturbances which may classify as of internal origin.

4. These digestive disturbances may originate in bad hygienic external conditions arising from the environment of the patient.

5. The colon bacillus is also met with in a virulent state in water, milk and other substances; ingested these may be classed as infections of external origin.

6. The prophylaxis of infections of external origin must be based on the maintenance of the integrity of the digestion and nutrition by exercise, diet, etc., in order to increase the resistant and phagocytic powers of the organism.

7. The prophylactic measures for infections of external origin demand also the timely and efficacious disinfection of the excreta of those attacked by tonsillitis, etc., or any of the other conditions mentioned above as being caused by the colon bacillus.

8. An additional precaution would be the withdrawal from sale of all food substances found to contain the colon bacillus by bacteriological analysis.

PRELIMINARY REPORT COMMITTEE ON STANDARD METHODS OF WATER ANALYSIS.

Mr. Geo. W. Fuller, Chairman, presented the report of the Committee on Standard Methods of Water Analysis which was, during the afternoon session, discussed at considerable length. At the request of the committee the publication of the primal report in the Transactions was postponed till next year and the following interim report substituted:

Your Committee on Standard Methods of Water Analysis presents as its first report of progress the results of a careful inquiry into the present status of the general subject. This inquiry was deemed necessary in order to bring to the committee needed information for guidance in its future plans of action.

About 125 copies of a circular letter, with an accompanying list of questions, were sent to leading workers. The number of detailed replies was fewer than should have been the case; but, notwithstanding this, these replies, with the knowledge which the members of this committee have as to the methods used in the more prominent laboratories, enable us to present a résumé[1] of existing conditions, which may be considered as substantially correct:

At the meeting of the Section at Indianapolis this report was discussed; and while but little specific information of importance was added to the data of the committee, it was evident that the members of the Section are in general accord with the spirit of the work. Individual conference during the sessions resulted in securing from a considerable number of leading workers an agreement to coöperate with the committee during the coming year in carrying on comparative experimental work upon several of the less definitely established points in the chemical and bacteriological examination of water. From information now in the hands of the committee and from experimental work now in progress it seems probable that in its next report your committee will be able to formulate a definite outline of standard methods for the collection of samples of water and sewage, their physical examination, their microscopical examination, and certain parts of their chemical analysis. There is also reason to believe that a substantial report of progress can be made upon the methods of quanti-

[1] This report was published in full in the "Engineering Record," Oct. 27, 1900, and in "Science." By permission of the Section the publication of the report in the "Proceedings" of the Association is postponed, the Committee reserving the right to incorporate such portions of the report and the discussion in its subsequent report as seem desirable. The object of this postponement is to prevent needless repetition and confusion.

tative bacteriological determinations, and upon the remaining methods of the chemical analysis. The replies to the circular letter sent out last year showed that the report of the Bacteriological Committee of 1897 has been effective in securing greater uniformity in the preparation of culture media and in general species determination, but they also showed that the report needs to be revised to conform with subsequent improvements in technique. In the absence of specific comparative data, however, a satisfactory revision cannot be made at the present time. It is the purpose of your committee to direct its energies during the coming year to securing such needed data, and it is hoped that at the next meeting of the Section this material will be available for discussion. The situation with respect to the isolation of B. coli communis and other fecal bacteria from water requires further study, but inasmuch as this subject has been assigned to a special committee of the Section, your Committee on Standard Methods of Water Analysis refrains at present from making an independent formal report.

From personal conversation and correspondence with the leading water analysts it can be stated that the sentiment in favor of uniform standard methods is generally becoming crystallized, and that the prospects for the ultimate formulation of a system of methods that will be generally recognized are most promising.

THE RAPID DIAGNOSIS OF RABIES.

By MAZYCK P. RAVENEL, M. D., and D. J. McCARTHY, M. D.

(From the Laboratory of the State Live Stock Sanitary Board of Penna., and the Pepper Clinical Laboratory, Phoebe A. Hearst Foundation.)

A rapid diagnosis of rabies is a matter of extreme importance for the physician and the patient, as well as for the general public. There is perhaps no other disease which strikes so much terror into the mind of the average person, and the cry of "mad dog" is a signal for general excitement. Anyone bitten by a dog supposed to be rabid heretofore has been kept in a state of nervous suspense until it could be definitely determined whether or not the animal was a victim to hydrophobia. Up to the present time the only sure means of diagnosis in the vast majority of cases has been the inoculation of rabbits from a portion of the nervous system of the animal inflicting the bite; a practice often impossible to carry out with any degree of certainty on account of the poor condition in which much material is collected. Even under the most favorable circumstances from two to six weeks had to elapse before a positive diagnosis could be made. As well stated by Babès, it would seem "That this disease, so clearly characterized by a train of symptoms, constant in their character, ought also to present characteristic lesions in the nervous centres, and especially in the ganglia which preside over the production of symptoms," an opinion which has been generally accepted and acted upon by many students, their object being not only to disclose the cause of the striking symptoms, but also to find a method of diagnosis more rapid and more certain than any yet known.

The first step in this direction seems to have been due to Pollailon and Nepveu, who described the lesions observed in a man who died of rabies. They noted that the whole cerebro-spinal axis was strongly congested and that the ganglion of Gasser was hyperæmic and infiltrated with round or oval cells, some of them being hyaline in appearance, and which they considered "probably epithelioid cells from the capsule of the ganglion cells." The work of Balzer, calling attention to the changes in the central nervous system, was followed in 1874 and 1875 by Benedikt's article, both authors describing the distension of vessels in the nervous centres, accompanied by an extravasation of erythrocytes and leucocytes into the perivascular spaces. Kolesnikoff in 1875 described besides, an invasion of the pericellular spaces by round cells occurring in the hemispheres, cerebellum, spinal cord, and

the sympathetic and intervertebral ganglia. Schaffer also made a careful study of the vascular and cellular changes found in the case of a man, and called attention to a hyaline and fibrillar degeneration and vacuolation of the cells of the anterior horns of the cord. In 1886 Babès concluded, as a result of numerous researches made in man and in dogs, both natural and experimental cases, that the essential lesion of rabies consisted in an accumulation of embryonic cells in the neighborhood of the central canal, and especially about the large modified cells of the motor centres of the bulb and cord. Writing again in 1892 Babès reaffirmed his observations and insisted on the profound changes taking place in the nerve cells. He held that it was possible to make a rapid diagnosis of the disease by a microscopic examination of the bulb and cord. He described in the bulb what he considered the diagnostic lesion of the disease namely, the pericellular accumulation of embryonal cells described by Kolesnikoff and for which he proposed the name "Rabic tubercle." The cells of the bulbar nuclei undergo degeneration and present the various stages of chromotolysis. There is loss of the prolongations and a progressive modification and even total disappearance of the nuclei, a dilatation of the pericellular space, and an invasion not only of the space but also of the nerve cells by embryonal cells, and at the same time small corpuscles which are hyaline, brownish, and in parts metachromatic. Many of the nerve cells become surrounded by a large zone of embryonal cells, and when the cell is completely degenerated these occupy the cell area and constitute the rabic tubercle. Since 1891 Babès has examined the bulbs of 487 dogs, controlling his results always by inoculation of rabbits. His results have led him to trust this means of diagnosis and he still holds it to be one of the best means of rapid diagnosis at our disposal, although except in Babès' own laboratory the method does not seem to have been practiced, at which he expresses a surprise which appears justifiable.

Recently Nélis, working with Van Gehuchten, discovered in the spinal ganglia of two men who had died of rabies, and of a number of animals, peculiar changes which they considered to be the diagnostic lesion of the disease. Normally, the peripherial ganglia of the cerebrospinal and sympathetic system are composed of a supporting tissue which contains in its meshes the nerve cells enclosed in endothelial capsules. They have confirmed all the lesions described by other authors, but in addition have noted what they consider to be more diagnostic than any other. The most profound, the most constant, and the earliest lesions are noted in the peripheral cerebral and sympathetic ganglia, but above all the changes in the intervertebral ganglion are the most marked. Among the changes, the most characteristic con-

sists in the atrophy, the invasion, and the destruction of the nerve cells brought about by new formed cells which appear between the nerve cells proper and their endothelial capsule. These changes are widespread, but few capsules remain unaffected, and in advanced cases the section has very much the appearance of an alveolar sarcoma. The authors have considered in detail the findings of previous workers, but without exception they consider them as secondary and without any importance, either in the production of symptoms or in making a diagnosis. They hold that Babès has attached an undue importance to his rabic tubercle. In their first publication they held that "these lesions are specific of the rabic infection, if not by their nature, at least by their localization." In a later note, in answer to objections raised by Nocard and others, Van Gehuchten says that "the lesions of the cerebro-spinal and sympathetic ganglia which he and Nélis have discovered are not specific of rabies in general; they are only specific of the disease as it occurs naturally." It is to be noted that the authors have made no claim regarding early diagnosis of rabies, but only a rapid method. Van Gehuchten says his method "concerns not a precocious diagnosis, but only a rapid diagnosis in rabies." This has been further shown by the experiments of Cuillé and Vallée, who, after inoculating dogs with the virus of rabies, sacrificed them at various times after the appearance of symptoms. They found that in animals in which the disease had just become manifest the lesions in the plexiform ganglion were slight or absent. They conclude that as a means of diagnosis the method of Van Gehuchten and Nélis has great value in the case of animals in which the disease has run its full course, ending in death.

The subject has been studied also by numerous veterinarians of note in Europe, notably Degive and Hébrandt of the State School at Cureghem, and Nocard and Valée of France, all of whom have obtained results confirming the value of the discovery. Quite recently, Crocq has made a most thorough and complete review of the literature on the subject and a study of the method. He believes that Van Gehuchten is mistaken in considering the perivascular and pericellular neo-formations described by Kolesnikoff and Babés as unimportant changes, and believes that by their constant character, their localization ,and evolution they have a considerable diagnostic value. He says: "The lesions described by Babés, and Van Gehuchten and Nélis are both remarkable. They are so great and so clearly defined that I can understand how the authors each on his side may have concluded that the alterations described by them were specific." The procedure of Van Gehuchten and Nélis is, however, more simple and rapid than the method of Babés, and on this account is to be preferred. Our own work leads us to believe that the changes in the intervertebral ganglia

are more constant than those in the bulb, as will be seen by reference to the summary below.

The method of procedure recommended by Van Gehuchten and Nélis is as follows: The ganglion is put at once into absolute alcohol, in which it is left for twelve hours, the alcohol being changed once. It is then transferred for one hour to a mixture of absolute alcohol and chloroform; next for one hour in chloroform; then for one hour in a mixture of chloroform and paraffin, and lastly in pure paraffin for one hour. The sections are put in the oven for a few minutes, then passed through xylol, absolute alcohol and 90 per cent. alcohol, after which they are stained for five minutes in methylen blue, according to Nissl's formula, differentiated in 90 per cent. alcohol, dehydrated in absolute alcohol and cleared in essence of cajuput and xylol. If frozen sections are cut they are put for a few minutes in 90 per cent. or 94 per cent. alcohol. In our work we have used 10 per cent. formalin for fixing our tissues. They are then transferred to 95 per cent. alcohol, and finally to absolute alcohol. For the most part the tissues have been cut without imbedding, being attached to blocks with the aid of mucilage of gum arabic, though in some cases celloidin has been used. For the bringing out of the chromatolytic changes the Nissl method has proved the best, but the capsular changes were best brought out in sections stained by hæmatoxylin and eosine. Since these latter changes are the most essential diagnostic features in the sections, we would suggest that material unfit for the Nissl method will still show the capsular changes when stained by hæmatoxylin and eosine. Up to the present time we have examined 24 cases of rabies, including 7 dogs suffering with street rabies, 1 cow, 1 horse, and 15 rabbits, which were inoculated from these animals, a few being of the second generation, i. e., inoculated from the first experimental animal. In all of these cases studied (24), except that of the horse suspected of rabies, we obtained positive results in the plexiform ganglia. In one case, however, the changes were slight, and more marked in the peripheral (distal) portion of the ganglion. In 21 of the 24 cases the bulb was examined for the rabic tubercle of Babès. Positive results were obtained in 19, though in 2 cases only chromatolysis, without distinct tubercle formation was present. It will be seen that in 2 cases the rabic tubercle of Babès was not found, while the lesions described by Van Gehuchten and Nélis were present, though in one of these the changes in the ganglion were so slight as to leave us in some doubt. In this case, however, the sub-dural inoculation of rabbits gave positive results, and the microscopic examination of these rabbits showed the bulbar lesions of Babès as well as those of Van Gehuchten and Nélis in the ganglia.

In the two cases mentioned in which the bulb showed only chromatolysis without distinct tubercle formation, the lesions in the ganglia were marked. One of these was the cow which had shown clinical symptoms, leading the veterinarian in attendance to suspect rabies. Two rabbits inoculated sub-durally with the brain of this cow both died with typical signs of rabies, and by microscopic examination both the rabic tubercle of Babès and the lesions of Van Gehuchten and Nélis were found.

Of the rabbits examined three had been inoculated with virus of the second generation from dogs having street rabies. One of these rabbits showed symptoms of the disease on the eleventh day after inoculation, the shortest time which elapsed in any of our cases between inoculation and the appearance of rabiform symptoms. The microscopic examination of these rabbits gave positive results.

Of the dogs examined four had shown unmistakable clinical signs of rabies, while three were only strongly suspected of the disease. All the cases were controlled by the inoculation of rabbits.

Our work has led us also to the study of a number of control cases which are as yet incomplete. So far as we have gone, however, they lead us to believe that the lesions described by Van Gehuchten and Nélis may for all practical purposes be regarded as specific of rabies. We bear in mind the opinion of Van Gehuchten himself, and held also by some other observers, that in dogs, at least, the changes in the cerebro-spinal and sympathetic ganglia are only specific of the natural or street rabies. The lesions produced by the experimental inoculation of the "fixed" virus are not as marked as those in natural cases, and at times may be completely absent. We have not experimented with a fixed virus, but in rabbits inoculated with street virus of the first and second generations the gangliar changes have been marked. We have been convinced that the discovery of Van Gehuchten and Nélis is of great importance from a scientific as well as a humanitarian standpoint. It can be rapidly and easily carried out, and should be a matter of routine in the examination of suspected cases of rabies in every laboratory.

In the examination of medulla several sections were taken at random for mounting, but serial sections, extensive investigations of different portion of the bulb were not made, inasmuch as we were investigating rapid methods of diagnosis only, and not the essential nature nor the presence of these tubercles in the central nervous system. It is with this understanding that we recommend the examination of the ganglia rather than the bulb.

From our study of this subject the following conclusions seem justified:

I. When present, the capsular and cellular changes in the intervertebral ganglia, taken in connection with the clinical manifestations, afford a rapid and trustworthy means of diagnosis of rabies.

II. That when these changes are not present it does not necessarily imply that rabies is not present. The lesions afford contributory evidence more or less valuable depending on the duration of the clinical manifestations.

III. That in certain cases when the capsular changes are slight, such as in animals dying or killed in the early stages of the disease, the changes are more marked in the distal end of the ganglion.

IV. That the rabic tubercle of Babès is present sufficiently often to furnish valuable assistance in cases where only the central nervous system is obtainable without any of the ganglia, but in cases where the ganglia can be had they offer a simpler and easier method of diagnosis than do the brain or cord themselves.

A NOTE ON THE DISINFECTANT AND DEODORANT PROPERTIES OF AMMONIUM PERSULPHATE.

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The powerful oxydizing effects of ammonium persulphate led us to suspect that it would have germicide and deodorizing properties. The experiments detailed below were carried out with the object of determining to what extent it might possess these qualities.

The formula of the salt is $(NH_4)\ SO_4$. It breaks up on solution in water, as per the equation: $2\ (NH_4)\ SO_4 + H_2O = 2H\ (NH_4)\ SO_4 + O$. Theoretically, 228 parts of the pure salt should yield 16 parts of oxygen by weight. The salt is white in color and yields a colorless solution. At ordinary temperatures within a few minutes after the solution is affected, bubbles of oxygen begin to form on the bottom and sides of the vessel, and if undisturbed bubbles still remain at the end of 48 hours. It is practically non-poisonous and has no odor. Although known for a long time it is only recently that by the introduction of electrical methods of manufacture it has been brought within a reasonable cost. The salt is stable in the solid form, but cannot be preserved in solution. The evolution of the oxygen is hastened by warming. Our experiments have been carried out in three ways: A suspension in water has been made from an agar culture not more than 24 hours old. Several drops of this were placed on bits of sterile filter paper, which were then dried, and immersed in solutions of the salt for different periods of time. In the second method, we have used the glass rods suggested by Hill. For the tests with anthrax spores silk threads have been employed. Observation of the cultures were kept up for 96 hours, and in a few instances reinoculation of fresh culture medium was tried before deciding the organism dead. The anthrax spore threads were thoroughly washed in sterile water before transferring them to the culture tubes. Bouillon was used almost entirely as culture medium.

TABLE OF THE VALUE OF AMMONIA PERSULPHATE AS A GERMICIDE.

Germ.	Method of Exposure.	Time required to kill.					
		2½ per cent. Solution.		5 per cent. Solution.		10 per cent. Solution.	
		Living.	Dead.	Living.	Dead.	Living.	Dead.
Prodigiosus.....	On glass rods....	55 min.	60 min.	25 min.	30 min.		
"	On paper	55 min.	60 min.	25 min.	30 min.	15 min.	20 min.
Diphtheria	On glass rods....	80 min.	90 min.	35 min.	40 min.	15 min.	20 min.
"	On paper	80 min.	90 min.	35 min.	40 min.	15 min.	20 min.
Typhoid	On glass rods....	110 min.	120 min.	60 min.	70 min.		
"	On paper	110 min.	120 min.	50 min.	60 min.		
Staph. Aureus...	On glass rods....	50 min.	55 min.	25 min.	30 min.		
"	On paper	40 min.	50 min.	20 min.	25 min.		
Anthrax Spores..	On silk threads..	20½ hrs.	21½ hrs.	12 hrs.	13 hrs.		

The deodorant power of the salt was tested on putrefying mixtures of blood. We found that 80 c.c. of a 5 per cent. solution were required to deodorize a litre of such material, the process being complete in 30 minutes. A marked decrease of odor was noted, however, at the end of 10 minutes.

AN INQUIRY INTO THE ROLE OF THE DOMESTIC ANIMALS IN THE CAUSATION OF TYPHOID FEVER.

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The study of house epidemics of typhoid fever in farming communities quite often illustrates certain defects of our knowledge as to the causation of typhoid in general.

The occurrence of a series of typhoid cases in an isolated farm house is but poorly explained by the detection of colon bacillus in a well. Here direct infection of the water supply by human excrement may be excluded, and the theory that the living typhoid bacilli may traverse many feet of soil lays a heavy tax upon one's reasonable faith in natural barriers. We assume that by whatever route the colon bacillus has reached a well, by the same route the typhoid bacillus may travel. But when we attempt to retrace the path of the colon bacillus from a farm well, the reasonable probabilities lead seldom to the bodies of man, and often to the bodies of animals, when we must either return to follow some more doubtful clew, or else confront the hypothesis that the intestines of an animal were in the route traversed by the typhoid bacillus.

It seems worth while then to inquire whether the typhoid bacillus can pass alive and virulent through the intestines of animals. If so, the very wide and nearly uniform distribution of typhoid fever in this country will have been explained better than on the theory that human excretions alone furnish the seed, and we shall recognize the need of precautions not heretofore suggested.

If, on the other hand, it is found that the typhoid bacillus cannot survive in the intestines of animals, we shall know that the prevention of typhoid fever is to be accomplished by the destruction of infectious material thrown off by man alone.

The belief that animals may serve as hosts of the typhoid bacillus and may pass on the infection to man, has abundant support in analogy; e. g., anthrax, rabies, glanders, vaccinia, plague, malaria, tuberculosis, actinomycosis, filariasis, trichinosis, and a considerable list of grosser parasitic affections.

It was formerly believed that animals suffered with typhoid. Roberts (1) in 1899 reported an epidemic among dogs in a town of India.

The symptoms were continued fever, diarrhea, and emaciation. In many post-mortems he found enlarged spleens, mesenteric glands inflamed and swollen, Peyer's patches swollen, large oval ulcers in the ileum, etc.

Serres (2) observed an outbreak of what he regarded as typhoid fever among the monkeys at the Museum of Natural Sciences in Paris, and says that he had previously seen the disease in monkeys, dogs, and cattle.

An outbreak of typhoid at Kloten (3) in Switzerland arose from a young man who was believed to have gotten his infection by eating the meat of a calf sick with typhoid fever.

Allen of Pietermaritzburg (17) saw cases of typhoid fever which he believed were caused by the milk of cows suffering with typhoid fever. He thought that he excluded other sources of infection. Power made similar observations.

Experimental research has apparently never included the detection of typhoid fever bacilli in the stools of animals, though the immunity of animals to typhoid fever has been well-nigh proven. Murchison in 1867 fed typhoid stools to pigs, with no results. Klein in 1875 repeated these experiments upon various domestic animals, and also fed typhoid stools to monkeys after setting up a diarrhea with Croton oil. Klein's (4) results, like Murchison's, were negative.

Birch-Hirschfeld reported that by feeding typhoid stools to rabbits he produced fever, diarrhea, and emaciation, and found at autopsy hypertrophy of the spleen and intestinal glands, and in one or two instances ulceration. By way of control he fed other animals with nonspecific diarrheal evacuations, and produced no such results. Bahrdt (5) in 1876 failed to confirm the results of Birch-Hirschfeld. Motschutkovsky, employing typhoid blood by inoculation both in men and animals, got no results.

Klebs and Chomjakov, using both the stools and cultures of the bacillus, by feeding, and by intraperitoneal and subcutaneous injection, obtained practically negative results, though some animals died with subnormal temperature.

Gaffky, in 1884, made a long and careful series of experiments with pure cultures injected subcutaneously and into the peritoneal cavity, and by feeding, with a view to determining whether characteristic results would follow. No such results were obtained.

E. Fraenkel (6) and Simmonds injected pure cultures of typhoid bacilli into the peritoneal cavity of 35 mice, and killed 27. Five rabbits were injected in the intestine, 5 subcutaneously, and 1 in the lung. None of these died. Of 20 rabbits injected intraperitoneally, 2 died;

of 46 injected in the ear vein, 20 died. The typhoid bacillus was recovered from the spleen in all the fatal cases.

A. Fraenkel (7) introduced the bacilli into the duodenum, and killed 7 out of 14 guinea pigs. These animals died from three to seven days after the experiment, and the bacillus was found in the spleen, but not in the small intestines. The bacillus was not recovered from the blood.

Michael (8), Fodor (9), and Seitz (10) confirmed these general results. Up to this point it would seem doubtful whether the typhoid bacillus has any sort of pathogenicity for the animals experimented upon. Later experiments go to show that while no animal seems capable of having typhoid fever, normal animals may be killed by cultures of typhoid injected into stomach, subcutaneous tissues, or peritoneum, and the bacillus may be recovered post-mortem from the spleen. A majority of animals, by measures designed either to diminish the resistance of the animals or to increase the virulence of the germ, may be rendered susceptible to fatal typhoid intoxication. Thus after rendering the stomach contents alkaline, and stopping peristalsis by opium, Koch and Seitz found that a dose of 10 c.c. of bouillon culture proved fatal to guinea pigs in more than half the cases.

Rachford (11) gave rabbits bicarbonate of soda by the stomach, and an intraperitoneal dose of morphia, after which he poured typhoid culture into the stomach. Ten of the rabbits died, and in two of these the pathological findings were characteristic, enlarged spleen, intestinal ulceration, swelling of Peyer's patches. Typhoid bacilli were recovered from the spleen. One rabbit he believed to have died of typhoid fever.

Sirotinin (12) and Beumer and Peiper (13), repeating the experiments of Koch and Seitz, concluded that the animals were killed by the soluble poisons in the culture media, and that the results were no more specific than those following experiments with cultures of non-pathogenic organisms.

Widal and Chantemesse (14) by injecting at the same time typhoid cultures under the skin, and sterilized streptococcus bouillon into the peritoneal cavity were able to recover a bacillus of increased virulence, and repeating the experiment through a series of 25 animals, obtained at last a typhoid bacillus which was fatal to mice and guinea pigs. These animals did not, however, have a disease resembling typhoid, but a septicemia.

Sanarelli also claimed to have produced in the bodies of animals a typhoid bacillus of increased virulence by growing it in association with sterilized cultures of colon bacillus, and of pyocyaneus. In the experiments of Germano and Maurea, who injected mice with 0.5 c.c. of typhoid bouillon, it was found that in those cases which were rapidly

fatal there was evidence of proliferation of the bacillus, but in the cases where death occurred after several days the bacilli in the tissues were far less numerous.

Cygnoeus (15), in addition to the methods of Chantemesse and Widal, fed typhoid cultures by mouth and injected the duodenum and small bowel through an abdominal wound. Of 16 rabbits, 9 died within eleven days, having fever and progressive weakness. Two rabbits fed by the mouth died in three to five weeks. Bacilli were found in intestines, spleen, kidney, and liver. From one rabbit injected in the vein of the ear he recovered typhoid bacillus from the feces. No other find of this sort appears to have been made in all these experiments.

The fatal results following experiments of whatever nature have seemed dependent rather upon the quantity of the culture used, or upon the increased virulence of the germ, than upon its activity within the body. Filtered cultures, or dead bacteria may be employed with fatal effect. Pfeiffer destroyed the bacilli on agar stroke cultures by exposure to chloroform vapor, and found that doses of 3 or 4 milligrammes of the dead bacteria were fatal to guinea pigs. Brieger was able to isolate from typhoid cultures a ptomain which was fatal to guinea pigs.

It is thus seen that the insusceptibility of lower animals to typhoid fever has been almost demonstrated. It does not, however, follow that the bacillus of typhoid fever may not live in the bodies of lower animals. The proof is only that the lower animals react to the typhoid bacillus but rarely, and in a non-specific manner. The typhoid bacillus has been found in the feces of human beings in good health, and therefore presumably immune (Remlinger and Schneider). It is also well known to have survived in the bodies of individuals long after recovery from typhoid fever.

The first requisite for such an inquiry as we propose is a satisfactory selective medium for the growth of the typhoid bacillus. The first successful medium was that devised by Elsner, which being inoculated with typhoid dejecta, restrained the growth of all the bacteria, except the typhoid bacillus and Bacillus coli communis. In this medium the typhoid colonies were distinguished by their smaller size and slightly different color. Elsner's medium is unsuitable for use in the incubator, since it becomes fluid at 37° C. The development of the colonies at a low temperature was necessarily slow. The colon bacillus appeared first, after about twenty-four hours, and the typhoid bacillus after forty-eight hours, or later. Thus it is likely to happen in plates too thickly inoculated that the colonies of typhoid bacillus become obscured by the faster growing colon bacillus.

A better medium for obtaining the typhoid bacillus from the stools is, as we think, that devised by Hiss (16), and described in the Journal of Experimental Medicine for November, 1897. His directions for preparing the medium are as follows: "The medium used for plating contains 10 grams of agar, 25 grams of gelatine, 5 grams of beef extract, 5 grams of sodium chloride, and 10 grams of glucose. Care should be taken to add the gelatine after the agar is thoroughly melted, so as not to alter this ingredient by prolonged exposure to high temperature. The glucose is added after clearing. The reaction of this medium is most important, and, if, as is usually the case, it is too alkaline, it is rendered of the desired reaction by adding the determined amount of normal solution of HCl. The medium should never contain less than 2 per cent. of normal acid."

Hiss lays special stress upon this exact reaction as determined by phenolphthalein, and he says that in such a medium he has been able to obtain pure colonies of the typhoid bacillus from a great many cases of typhoid fever, as well as from greatly diluted suspensions of the typhoid bacillus in water. This medium remains semi-solid in the incubator. In 24 hours, if any typhoid colonies develop, they will present a typical appearance under a low power of the microscope, and can be easily transferred by the pointed needle to other suitable media.

The typical colonies of the typhoid bacillus are thus described: "As seen under the lower power, the deep typhoid colonies are small, generally spherical, with a rough, irregular outline, and by transmitted light are of a vitreous greenish, or yellowish green color. The most characteristic feature consists of the well defined filamentous outgrowths, ranging from a single thread to a complete fringe around the colony. The young colonies at times are composed solely of threads. The fringing threads generally grow out at right angles to the periphery of the colony, and can be seen by focusing up and down to be decidedly connected with it."

The Hiss method seemed useful for recovering the typhoid bacillus from the feces of animals after feeding experiments, but before beginning such investigations we determined to find out whether the medium would make a selective culture of the typhoid bacillus when inoculated with various materials containing this germ.

In order to test the efficacy of this method we first plated out 15 specimens of urine from typhoid fever patients. From eight of these specimens we obtained numerous colonies of typhoid bacilli, which exactly correponded to the description given above, and also proved their identity completely by the usual cultural tests for the typhoid bacillus, and by the Widal reaction with known typhoid blood. We

also made cultures from 12 typhoid stools, but only obtained colonies of the typhoid bacillus in two cases. These were typical in all respects however, and as in most of the cases the disease was well advanced, or convalescent, the typhoid bacilli may have been no longer present in the stools. We also made artificial mixtures of the colon and typhoid bacillus, and were always able to recognize and to recover the typhoid organism. Pure cultures of the typhoid bacillus also showed characteristic growth in Hiss' medium, and we identified an organism which was obtained from the gall bladder as the typhoid bacillus, by its characteristic appearance in this medium, and proved its identity by all the culture and reaction tests.

From our experience with this medium, we were convinced that the typhoid organism, if present, might in a certain proportion of experiments be recovered from the feces of animals. Hiss' medium was therefore used in all of our feeding experiments upon animals.

Our first series of animals consisted of two chickens, two white rats, and a calf six weeks old. We inoculated a liter flask of bouillon with the typhoid bacillus, and allowed it to develop in the thermostat for 48 hours. One-half of the bouillon was fed to the calf in its milk, and the other half was mixed up in the grain given to the chickens, and poured upon the bread eaten by the white rats. The animals were fed in different cages from those in which they were afterwards confined, in order to eliminate any error from admixture of the infected food with the feces. The feces were collected by introducing a sterile glass tube into the rectum, or simply by using the voided material. The rats were caused to defecate when specimens were wanted, by grasping them with long forceps just above the pelvis. A slight squeeze of the abdomen always produced an evacuation. The cages were also thoroughly sterilized between each series of experiments.

The feces were diluted in sterile water, and plate cultures were made from these in Hiss' medium every day for two weeks. Almost the only organism which we obtained was Bacillus coli communis, which we proved by the various typical cultural reactions. Occasionally we met with colonies with a slight resemblance to typhoid colonies, and whenever we found such colonies we obtained pure cultures and subjected them to all of the cultural tests for the typhoid bacillus, and the Widal agglutination test with known typhoid blood. None of these colonies turned out to be typhoid organisms, and we were never able to recover the typhoid germ from the feces, even though we had given animals larger doses of typhoid bacilli than they would probably even obtain by natural methods.

In our second series of experiments we used the same animals, but fed them with the same doses of typhoid every other day for two

weeks. Cultures were made every day for this time, but we were not able to isolate a single colony of the typhoid bacillus.

Our next set of experiments was performed upon a male pig, who was given one liter of a 24-hour typhoid culture in his food every day for one month. The feces were examined every day during this time by Hiss' method for typhoid bacilli ,and several hundred colonies were tested for the properties of the typhoid bacillus. Not one specimen of the typhoid bacillus was obtained during the entire month. Six specimens of urine were examined also, but with negative results.

At the end of the month, three days after the last typhoid feeding, the pig was killed, and cultures were made from the various viscera, but no typhoid bacilli were found. Cultures were also made from the stomach and the large and small intestines, and in agar, as well as Hiss' plates used. We were not able to recover any typhoid bacilli from any of the cultures excepting a few colonies of typhoid from the liver. The viscera all appeared normal, and there was no traces of any ulcerations in the intestines. Sections were stained and studied from the viscera, especially the stomach and intestines, but nothing abnormal was found. It will be seen that after one month's feeding we were not able to recover the typhoid bacillus, even at the autopsy from the intestines.

Our last set of experiments was performed upon a young female pig, and since we were able to carry out a thorough series of tests, we shall present our results in this case somewhat in detail. The pig was given daily one liter of a 24-hour culture of the typhoid bacillus, and the feces were taken from the rectum by means of two sterile glass tubes, one passed through the other, so as to avoid contamination from the external parts. The feces were plated in Hiss' medium daily, but no typhoid bacilli were found, although the tests and feeding were carried on for one month. The urine was also examined six times for typhoid bacilli, but none were found.

In order to find out whether the presence of typhoid bacilli in the intestines would produce any effect on the blood, a number of Widal tests were made at regular intervals during the month. Ten tests in all were made, but even at the end of the month the agglutination reaction failed at a dilution of one to twenty. The fact that the prolonged introduction of typhoid bacilli into the alimentary tract will not cause any marked agglutinative reaction is in contrast to the condition which can be brought about by the introduction of gradually increasing doses of the typhoid bacillus into the sub-cutaneous tissues. By carefully regulating the dose we have already been able to raise the agglutination power in the blood of this same pig to a dilution of 1-4000.

The temperature of this pig was carefully recorded during the month by feeding, and no considerable variation was noted. The temperature never went above 41° C., and never fell below 40° C., so that the feeding of typhoid bacilli did not cause any decided temperature reaction.

CONCLUSIONS.

In our experiments we have endeavored to produce infection through the natural route and by natural means, by simply allowing the various animals to take in very large quantities of typhoid bacilli in their daily food. Although at least 500 colonies from the feces were carefully tested, we were not able to demonstrate the presence of any typhoid bacilli in two chickens, two white rats, two rabbits, two guinea pigs, one calf, and two pigs. Although we have not employed a large number of animals, we feel justified in expressing the opinion that the typhoid bacillus cannot as a rule maintain its struggle for existence in the intestines of the domestic animals. We therefore conclude that the dejecta of animals play no considerable part in the distribution of typhoid fever.

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The report of the Committee Upon the Colon Bacillus was made by Dr. V. A. Moore, who explained that while the various members of the committee were each engaged in studying some special aspect of the problems involved and some of the members had presented papers at the present meeting, the committee as a whole was not prepared yet to present a formal report.

The report of the Committee Upon the Bacteriology of Milk was read by Dr. H. L. Russell.

During the afternoon session, the following resolution was introduced by Dr. H. L. Russell:

Resolved, That the members of this section, and of the Association, here assembled, tender a vote of thanks to Dr. Edenharter for the use of the Bacteriological Laboratory of the Central Hospital for the Insane, and for the many other courtesies; and that we express our commendation of his efforts in providing this laboratory for the advancement of medical science in connection with the Indiana Central Hospital for the Insane.

Seconded and carried by a unanimous vote.

RECENT WORK ON TUBERCULOSIS.

By EDWARD R. BALDWIN, M. D., Saranac Lake, N. Y.

The following recent work on tuberculosis was presented by the Chairman:

Among the many contributions on this subject during the past year, I can select only those which I conceive to be of most interest to this Section.

Considerably renewed interest appears to have been excited in culture media for the tubercle bacillus by Hesse's (1) agar for sputum. Ficker (2), Römer (3), and C. Fraenkel (4) have published their observations concerning it together with further attempts to obtain favorable or selective media for this organism.

Ficker makes a comparative study of solid media, with a good technic to secure uniform amounts for transplantation, using homogeneous emulsions of five to six weeks old neutral glycerinated agar cultures for seed. He was unable to note growth on Hesse's agar when pure cultures were sown, although with sputum he was successful. Hence, he regards the mucus as a favoring element, and by control tubes of ordinary agar (glycerine-free) was able to demonstrate growths from sputum, though they were less vigorous. Plain agar is well known not to be favorable. He also found multiplication of T. B. in the sputum kept in an incubator, but thinks that Hesse's medium further favors it.

Experiments with sputum-serum, one to three; and sputum-agar, equal parts, both with 2 per cent. glycerine, showed favorable influence of mucus. Acid-reacting sputum furnished the best growths. Similar favorable results were obtained by tests of acid potato-agar and serum. He also employed Proskauer and Beck's various synthetic solutions added to serum. By excluding one ingredient after another he found acid potassium phosphate ($KH_2\ PO_4$) alone was quite as effective as with all the others; 0.5 per cent. added to serum with 2 per cent. glycerine was the best. The same amount of neutral salt ($K_3\ PO_4$) does not act favorably, so he regards the acid radicle of most importance. Further tests with broth showed the favorable influence of acid reaction.

Efforts were made to find an animal tissue that would prove favorable as a culture medium, having an acid reaction after death, and possibly preserve more nearly the natural virulence of the T. B. Accordingly he discovers that brain, steamed to coagulate it, sliced and

moistened with 3 per cent. glycerine, proves an astonishingly favorable medium, while a thick broth made from equal parts of brain and water added in equal parts to serum or 2.5 per cent. agar, with 3 per cent. glycerine, give well-marked colonies in six to eight days. No great difference was observed whether human, beef, calf, sheep or horse brain was used. So far as examined, the morphology and virulence of the bacilli were not noticeably changed from the usual types found in young, rapidly-growing cultures.

Ficker also tried cultures made from beef and human lung, spleen, testicle, liver, kidney and pancreas. None were so favorable as brain, the next in order being beef-spleen-agar. Fifty per cent. emulsions were the most favorable quantities to add in preparing serum and agar. Other proportions, and also all filtered media from these organs, were markedly less favorable, as were those made neutral or alkaline. There was a limit, however, to the favorable acid reaction. In the case of brain emulsion it should not exceed 2 per cent. $\frac{n}{1}H_2SO_4$. As a suggestive conclusion Ficker proposes that investigation may show some connection between predisposition or susceptibility and the varying reaction of the bronchial secretions.

Römer confirms Hesse's observation as to the greater rapidity of growth of T. B. on Hesse's agar, when hourly comparison is made, with ordinary serum and agar plates sown with pure cultures. He finds no difference, however, when sputum is used, and hence attributes the result, as does Ficker, to the mucus but not to the especially favoring influence of Heyden's food in Hesse's formula.

Experiments with non-tuberculous sputum washed and smeared over plates gave a quicker growth when planted with pure cultures than without the mucus. Sterilized mucus was not favorable. He explains the favorable action of mucus by the fact that it is the natural covering for the bacillus, and, while not alone sufficient, favors it when other pabulum gains access by diffusion into it.

C. Fraenkel gives an interesting summary of this subject in general, describing the various attempts to isolate or identify the T. B. from secretions without first resorting to animal inoculations. He fully confirms Hesse's observations as to the rapid growth of T. B. from sputum, and obtained pure cultures readily after three to four days, using carefully washed sputum and transplanting from uncontaminated areas found to contain growing T. B. The sputum should be fresh and smeared very thinly for best results, and the plates kept in a moist chamber. Fraenkel thinks the Heyden's food is especially adapted for T. B. but not for other bacteria, and therefore helpful for isolating T. B., though not so good as glycerinated serum for cultures; that mucus has some importance, but does not explain the

growth on Hesse's plates since there is no such development from sputum on ordinary agar, or that made with potato, asparagin, etc. He tried various foods as substitutes for Heyden's in preparing agar. In comparative tests with pure cultures glycerinated serum and agar came first in order of excellence, then Heyden's, plasmon, serum-agar, somatose, eucasin, nutrose, sanatogen and mutase-agar.

When sputum was used, the order was changed, as most of them gave a quick overgrowth with other bacteria. Heyden's and plasmon-agar were first; then glycerinated, eucasin, nutrose, sanatogen, and mutase-agar. Widely varying quantities of these ingredients, from 1-10 per cent. to 16-18 per cent., were useful, and varying reactions were tolerated, but acid better than alkaline.

My experience with Hesse's agar has been favorable in growing T. B. quickly from sputum, but not for further culture, for they soon reach a limit and have to be transplanted to other media. I think this is easily explained by the absence of phosphatic salts in Hesse's formula except as contained in Heyden's food, probably only in small percentage. If meat extract is added it makes a good medium for T. B., both liquid or solid, but also for other bacteria, and thus is not useful in planting sputum for T. B. It is easy to see the serpentine threads with a low power on the fifth day, and to select spaces intervening between contaminating colonies of other bacteria for transplantation.

Jochmann (5) obtains still more favorable results by doubling the quantity of agar in Hesse's formula, but describes a diagnostic method for sputum, urine, etc., which commends itself for greater simplicity. This is the use of a broth from the same formula without the agar. Sputum (10 c.c.) or urinary sediments are mixed with 20 c.c. of the broth and incubated twenty-four hours. Examination after sedimentation shows considerable increase of the T. B.

Another method to facilitate the discovery of T. B. in urine and feces is proposed by Grassberger (6). It consists in the addition of two volumes of alcohol before centrifugation for the purpose of lessening the sp. gr. and thereby throwing down suspended bacteria. Coarser particles may first be centrifugated out. It is obviously not adapted for highly albuminous fluids.

I believe the Hesse's plates are of greater value for the isolation of T. B. than for the diagnosis. It is evident from the various reports that most of the T. B. in sputum are capable of growth, a most important fact brought out by Hesse.

We have used in our laboratory the brain media described by Ficker with marked success. They furnish the most luxuriant and rapid

growths that I have seen. We employed calf and hog brain with sheep serum, and found pronounced growth in four days.

The serum agglutination of the T. B. has been the subject of contradictory reports during the past year. On the one hand Arloing and Courmont (7) reiterate and further support their earlier claims by more cases and confirmation by Bendix, (8) while Beck and Rabinowitsch, (9) and C. Fraenkel (4) find the test very unreliable. They all used cultures obtained from Courmont which have the curious property of growing rapidly under broth in a homogeneous manner totally unlike the classical T. B. Beck and Rabinowitsch state that they have cultures from sputum and bovine origin respectively that have this property, and Dr. Trudeau had broth cultures of avian bacilli eight years ago that grew readily under the fluid, but chiefly in a mucoid mass on the bottom. We unfortunately allowed them to die out some years ago. Courmont obtained his from the condensation water in a potato tube frequently agitated. In its rapid growth and loss of virulence it differed from those of Beck and Rabinowitsch, though otherwise very similar. Both Beck and Rabinowitsch and Fraenkel call attention to its resemblance to the group of acid-resistant bacilli isolated from butter and grass both in staining properties and virulence Using turbid cultures of their butter bacillus Beck and Rabinowitsch found agglutination with various serums the same as with Courmont's culture, and do not regard it as a specific reaction for tuberculosis. They prefer the term "clarification" instead of agglutination, since the motility at first surmised appears to be merely molecular motion. The phenomenon needs further study.

The relationship of the eight or more acid-resistant bacilli up to present described to the T. B. has excited constant study. Mayer (10) has made a comparative study with cultures and inoculations of four of them together with bird, fish and human T. B. He found in the various butter and grass bacilli minor differences which disappeared in fourteen-day agar cultures, but persisted in those on broth. They were found quite innocuous to guinea-pigs and rabbits injected intraperitoneally unless mixed with butter. In the latter method localized fibrinous lesions were formed, which were not wholly characteristic of true T. B. He thinks the butter formed a protection for the bacilli at first, while they multiplied in the animal.

I have been unable to kill guinea-pigs with a timothy grass bacillus answering to Moeller's description which we isolated two years ago.

A second butter bacillus is announced by Korn (11) which is pathogenic for rabbits in contrast to his earlier one, which is fatal only to white mice.

This group of pseudo-bacilli is undoubtedly important in diagnosis, but does not seem to have seriously interfered in sputum examination, however confusing in milk and butter tests.

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(2) Ficker. Cent. f. Bakt. Parasit., xxvii, Nos. 14, 15, 16, 17.
(3) Römer. Cent. f. Bakt. Parasit., xxvii, Nos. 21, 21.
(4) Fraenkel. Hygienische Rundsch., x, No. 13.
(5) Jochmann. Münchener Med. Woch., No. 22, May 29, 1900.
(6) Grassberger. Münchener Med. Woch., No. 16, April 17, 1900.
(7) Arloing and Courmont. Zeitsch. f. Tuberc. u. Heilstät., Nos. 1 and 2, Vol. 1.
(8) Bendix. Deutsch. Med. Woch., No. 14, April 5, 1900.
(9) Beck and Rabinowitsch, do., No. 25, June 21, 1900.
(10) Mayer, Cent. f. Bakt., xxvi, Nos. 11, 12.
(11) Korn, do., xxvii, Nos. 14, 15.

THERMAL DEATH POINT OF THE TUBERCLE BACILLUS AND ITS RELATION TO COMMERCIAL PASTEURIZATION OF MILK.

By H. L. RUSSELL and E. G. HASTINGS, Madison, Wis.

Owing to the fact that tuberculosis is a more or less frequent disease among cattle, particularly among dairy cattle, and also because the organism causing the same has been suppposed to be endowed with peculiar powers of resistance against heat, it has been suggested that the thermal death point of this germ be used as a standard for the treatment of milk by pasteurization.

By this process not only must the keeping quality of milk be increased, but all disease-bacteria should be destroyed; and these results should be accomplished with as little change in the physical characters of the milk as possible.

The limits that have hitherto been most largely used have been determined by the temperature at which a cooked taste appears in milk or cream. This is about 70° C., and therefore the heat limit that has been used is one just below that at which this change in flavor becomes pronounced, 65-68° C.; the time limit being determined by the exposure necessary to kill with certainty the tubercle organism under these conditions. But even at this temperature the constitution of milk is more or less altered. One of the writers (R.) in connection with Babcock has found that when cream is heated to a temperature of 60° C. or above, its consistency or "body" is very much reduced; also the cream fails to rise on milk when so heated. This condition interferes materially with the sale of these products, for it gives the consumer the idea that they are deficient in butter-fat, which is the normal measure of the value of the milk.

We further found that the cause of this diminished consistency was due to a change which occurs in the arrangement of the fat globules in the milk or cream. In the raw product the tiny fat globules are aggregated together in microscopic clusters. When heated to a temperature above 60° C. this aggregation is broken down and the fat globules are homogeneously distributed throughout the milk serum. If milk is pasteurized at a temperature of 60° C. or below, this change does not occur. To successfully pasteurize at this temperature, it would, of course, be necessary to prolong the exposure somewhat, and inasmuch as the death limit of the tubercle bacillus gives us a good standard, a most careful determination of the length of exposure at 60° C. becomes necessary.

Concerning these death limits at different temperatures, there is considerable difference of opinion even on the basis of experimental tests, but the standards that have hitherto been accepted as most reliable are those of de Mau[1], who made his determination with broken-down, semi-fluid, cheesy material derived from tuberculous udders.

His results briefly are as follows:

Temperature.	Time.
55° C (131° F.)	4 hours.
60° C (140° F.)	1 "
65° C (149° F.)	15 minutes.
70° C (158° F.)	10 "
80° C (176° F.)	5 "
90° C (194° F.)	2 "
95° C (203° F.)	1 "

On the basis of this determination it would take one hour at 60° C. to destroy this organism. Manifestly this length of exposure would be beyond the limit of economical commercial treatment as it would seriously curtail the capacity of a pasteurizing plant.

About the time we were experimenting upon the practical side of this question, Dr. Theobald Smith's researches were published[2] in which he showed that the thermal death point standards hitherto accepted for the tubercle bacillus needed revision. He found that an exposure from 15-20 minutes at a temperature of 60° C. was sufficient to destroy the tubercle organism when exposed in distilled water, normal salt solution and bouillon. In milk, however, results were discordant; where the determinations were made in tubes exposed to the air it required a much longer period of exposure (one hour), to kill with certainty, but if such tubes were sealed, the organism was no more resistant in milk than in any other liquid.

The importance of these findings was very evident and had a direct practical bearing on the question of proper pasteurization, for if the tubercle bacillus could be killed at 60° C. in 15-20 minutes, instead of one hour claimed by de Mau, then it would be possible to introduce this new standard for pasteurizing that would eliminate the only objection ever raised against pasteurized products, while at the same time all of the advantages of a higher exposure would be retained.

During the past year this retest has been made. Tubercle organisms of bovine origin have been used from a variety of sources. Through the kindness of Dr. Th. Smith and Dr. M. P. Ravenel, we have been able to secure cultures from different sources that would

[1] Arch f. Hyg., 1893, 18:133.
[2] Journal of Expt. Med., 1899, 4:27.

represent any possible range in pathogenicity. Three different cultures were thus used, one of which had been isolated from an affected cow for only a few months. Cultures of the same were grown on dog's blood serum, in closed tubes with an air vent, and after a copious growth had developed, the bacilli were transferred to a sterile tube and rubbed up with sterile physiological salt solution until the fluid was uniformly turbid. This made a dense homogenous suspension which was then added directly to fresh milk.

The pasteurizing was accomplished by heating the milk in a 50-gallon rotating commercial pasteurizer which was tightly closed from the air. In order to economize in amount of culture needed, the tuberculous milk was put in large tubes closed with a cork and protected by a rubber guard from breakage. The objection might possibly be urged that in this way the conditions did not conform to those that would obtain in the vat outside, but this was tested by making an exposure under both conditions of a micrococcus that would withstand 60° C. To lessen the time required to bring the infected milk to 60° C., the pasteurizer was held at this constant temperature, and the tubes heated quickly in a water bath. The period of exposure was noted from the time the tubes reached the proper temperature and were immersed in the large pasteurizer. The tubes were removed at varying intervals, and from 1 to 2 cc. of the infected milk injected intraperitoneally into guinea pigs. Where animals did not die, they were chloroformed after a lapse of a varying period of time and post mortem examinations made, tissues being taken for sectioning in all cases where diagnosis could not be positively determined.

It is unnecessary to give here the complete data relating to these various tests, as they will be published elsewhere, but the following summary indicates briefly the results obtained.

SERIES.

Time of Exposure (min.)	1	2	3	4	5
45	— * —				
30	— —				
20		— —			— —
15	— —	— —			— —
10		— —	— —	— —	— —
5			+ +	+ +	
0 (Unheated)	+	+	+	+	+

* Tuberculous animals, +; no development of tuberculosis, —.

In all cases the unheated milk (0 min.) that served as a control produced tuberculosis that invariably ran a rapid course, generally ending in death within a period of 15-19 days.

With the samples of milk subjected to the pasteurizing treatment, there is a sharp differentiation in the inoculation results. Without exception those cases when the exposure to the heat was only five minutes resulted in the production of tuberculosis, the majority of cases showing a generalization of the disease, which either terminated fatally or would have done so in a period varying from two to four months.

These results are in striking contrast with those obtained in the cases where the time of exposure was for ten minutes or longer. In every case the animals inoculated with milk heated for a period of ten minutes and longer remained free from tuberculosis.

The evident conclusion from these tests is that an exposure of ten minutes or more at 60° C. completely destroyed the vitality of the tubercle organism when inoculated into the most susceptible portion of highly susceptible animals, while an exposure for a shorter period of time (five minutes) invariably produced the disease.

It has been advocated by some that pasteurization can be as efficiently done in such open vessels as bottles, as it can in bulk in commercial pasteurizing plants. This method has been especially recommended for family use where a small daily supply is needed. In the light of Theobald Smith's work it would seem that conditions permitting of the formation of a scalded "skin," i. e., exposure to the air, would increase the resisting power of the organism. Comparative experiments were therefore made as to the effect which the manner of exposure had on the organism. Two series of experiments were carried out on cultures heated in the commercial pasteurizer in an agitated condition, and also in a quiescent condition in an open vessel.

The following summary gives the results obtained.

TIME OF EXPOSURE. (MIN.)	CONDITION OF MILK DURING PASTEURIZATION.			
	Series I.		Series II.	
	Agitated.	Quiescent.	Agitated.	Quiescent.
15				+ +
10	— — *	+ +	— —	+ +
5	+ +	+ +		
0 (Unheated)	+	+	+	+

* + or — denotes whether the inoculated animals acquired tuberculosis or not.

It is evident from this that the results obtained in each series by either method of exposure are confirmatory of each other; but that

the results of each method are sharply contrasted. Where the milk was exposed in an open receiver in a quiescent condition the tubercle bacilli were more resistant, although those limits were not accurately determined. When the milk was heated in an open vessel at 60° C., signs of a thin "skin" could be detected with the unaided eye in about twenty minutes. In all probability these flocculent patches would begin to make their actual appearance before they could be recognized by the unaided eye, and it seems that they protect in some way the living bacilli so that they are not acted on so readily by the heat.

In comparing these results obtained under commercial conditions with those of Smith, who worked under laboratory conditions, a close agreement is to be noted. In only one case did he find that a net exposure of fifteen minutes failed to kill; in all other cases this exposure was fatal.

The matter of five minutes would not materially affect the treatment from an economic or practical point of view, and to be on the safe side, it is preferable to extend the limit somewhat over that actually noted in these experiments. An exposure for fifteen to twenty minutes at 60° C. would certainly destroy all signs of vitality where the milk was heated in a closed pasteurizer. Pasteurization in open pans for the above reason should be discouraged. It is possible to prevent direct access of air by tightly corking the bottles, and under these conditions individual pasteurization can be quite as effectually performed as in a specially designed apparatus for the commercial handling of this product.

This standard has now been in actual practice for over a year at the University of Wisconsin Dairy School Creamery, and has given excellent satisfaction. Cream and milk heated to this temperature (60° C.) for 15-20 minutes is very much enhanced in keeping quality, is not affected in taste, flavor or creaming properties, and above all is thoroughly freed from disease-producing bacteria such as tuberculosis. It is already well known that typhoid fever and diphtheria organisms are destroyed under these conditions.

CONSTITUTION

OF THE

AMERICAN PUBLIC HEALTH ASSOCIATION.

TITLE.

I. This Association shall be called "The American Public Health Association."

OBJECTS.

II. The objects of this Association shall be the advancement of sanitary science, and the promotion of organizations and the measures for the practical application of public hygiene.

MEMBERS.

III. The members of this Association shall be known as Active and Associate. The Executive Committee shall determine for which class a candidate shall be proposed. The *Active* members shall constitute the permanent body of the Association, subject to the provisions of the constitution as to continuance in membership. They shall be selected with special reference to their acknowledged interest in, or devotion to, sanitary studies and allied science, and to the practical application of the same. The *Associate* members shall be elected with special reference to their general interest only in sanitary science, and shall have all the privileges and publications of the Association, but shall not be entitled to vote.

Delegates from national, state, provincial, and municipal boards of health, organized sanitary associations, and the army, navy, and marine hospital service, shall be entitled to be enrolled as active members upon presentation of their credentials to the Executive Committee. Members, not delegates from such bodies, shall be elected as follows:

Each candidate for admission shall first be proposed to the Executive Committee, in writing (which may be done at any time), with a statement of the business or profession and special qualifications of the person so proposed. On recommendation of a majority of the committee, and on receiving a vote of two thirds of the members present at the regular meeting, the candidate shall be declared duly elected a member of the Association. The annual fee of membership in either class shall be five dollars.

OFFICERS.

IV. The officers shall be a President, a First and a Second Vice-President, a Secretary, and a Treasurer, and the officers of the various sections.

All the officers shall be elected by ballot, annually, except the Secretary, who shall be elected for a term of three years.

PRESIDING OFFICER.

V. The President, or in his absence one of the Vice-Presidents, or in their absence a chairman *pro tempore*, shall preside at all meetings of the Association. He shall preserve order, and shall decide all questions of order, subject to appeal to the Association. He shall also appoint all committees authorized by the Association, unless otherwise specially ordered.

SECRETARY.

VI. The Secretary shall have charge of the correspondence and records of the Association; and he shall also perform the duties of Librarian. He, together with the presiding officer, shall certify all acts of the Association. He shall, under the direction of the Executive Committee, give due notice of the time and place of all meetings of the Association, and attend the same. He shall keep fair and accurate records of all the proceedings and orders of the Association; and shall give notice to the several officers, and to the Executive and other committees, of all votes, orders, resolves, and proceedings of the Association, affecting them or appertaining to their respective duties.

TREASURER.

VII. The Treasurer shall collect and take charge of the funds and securities of the Association. Out of these funds he shall pay such sums only as may be ordered by the Association, or by the Executive Committee. He shall keep a true account of his receipts and payments, and at each annual meeting render the same to the Association, when a committee shall be appointed to audit his accounts. If, from the annual report of the Treasurer, there shall appear to be a balance against the treasury, no appropriation of money shall be made for any object but the necessary current expenses of the Association, until such balance shall be paid.

STANDING COMMITTEES.

VIII. There shall be the following standing committees: (1) The Executive Commitee, (2) the Advisory Council, (3) the Committee on Publication.

EXECUTIVE COMMITTEE.

IX. The Executive Committee shall consist (1) of the President, First Vice-President, Second Vice-President, Secretary, Treasurer, and Chairmen of the various sections; (2) of six active members of whom three shall be elected annually by ballot to serve two years, and who shall be ineligible to reëlection for a second successive term; and (3) of the ex-presidents of the Association.

It shall be the duty of the Executive Committee to consider and recommend plans for promoting the objects of the Association, to authorize the disbursement and expenditure of unappropriated moneys in the treasury for the payment of current expenses; to consider all applications for membership, and at the regular meetings, report the names of such candidates as a majority shall approve; and, generally, to superintend the interests of the Association and execute all such duties as may, from time to time, be committed to them by the Association. At least one month preceding the annual meeting of the Association, the Executive Committee shall cause to be issued to members a notice of such meeting, and they are authorized to publish the same in medical, scientific, and other periodicals, but without expense to the Association; and such notice shall contain the order of business to be followed at said meeting, and, briefly, the subjects to be presented and the special points of discussion.

ADVISORY COUNCIL.

X. The Advisory Council shall consist of one member from each state, territory, and district, the army, navy, and marine hospital service, the Dominion of Canada, and each of the Provinces, who shall be appointed by the President on the last day of each session, and who, besides acting as nominating committee of officers for the ensuing year, to be announced at such time as the Executive Committee may appoint, shall consider such questions and make such recommendations to the Association as shall best secure the objects of the Association. They shall at their first meeting elect from their own number a Secretary, whose record of their proceedings shall be made part of the records of the Association.

COMMITTEE ON PUBLICATION.

XI. The Committee on Publication shall consist of a Chairman, the Secretary of the Association, the Treasurer of the Association, and a member of each section of the Association, with the President of the Association, *ex officio;* who shall contract for, arrange and publish, under authority of the Executive Committee, the proceedings of the Association, including such papers as have been examined and

approved by the Executive Committee, or which have been submitted to them by the latter for their discretionary action.

REPORTS AND PAPERS.

XII. All committees preparing reports to be presented to the Association must submit the same to the Publication Committee not later than 30 days before the succeeding annual meeting of the Association; and all papers other than committee reports shall be in the hands of the Secretary of the Association not less than 20 days before.

MEETINGS.

XIII. The time and place of each annual meeting shall be fixed at the preceding annual meeting, but may be changed by the Executive Committee for reasons that shall be specified in the announcement of the meeting. Special meetings may be called at any time or place, by concurrence of two thirds of the Executive Committee. There shall be no election of officers, or change of by-laws, or appropriation of money to exceed the amount at that time in the treasury, at such special meeting, execpt by a vote of a majority of all the members of the Association. Whenever a special meeting is to be held, at least one month's notice shall, if possible, be given by circular to all the members, together with the order of business.

QUORUM.

XIV. At the annual meeting nine members shall constitute a quorum for the election of officers, a change of the constitution, the election of members, and the appropriation of moneys.

ORDER OF BUSINESS.

XV. The order of business at all meetings of the Association shall be fixed by the Executive Committtee, and such order must be completed before any other business is introduced, except such order of business is suspended by a vote of four-fifths present.

ALTERATION OF CONSTITUTION.

XVI. No alteration in the constitution of the Association, shall be made except at an annual meeting, or unless such alteration shall have been proposed at a previous meeting, and entered on the minutes with the name of the member proposing the same, and shall be adopted by a vote of two-thirds of the members present.

XVII. Members of the Association may be authorized to form themselves into sections by vote of the Association at any annual meeting; such sections shall have power to nominate their officers to be elected by the Association, and to make by-laws which shall go into effect when approved by the Association.

BY-LAWS OF THE EXECUTIVE COMMITTEE.

QUORUM.

1. Five members shall constitute a quorum for the transaction of such business as may come before the committee.

MEMBERS RESTRICTED.

2. No elective member of the Executive Committee shall be at the same time a member of the Advisory Council, if there is another member of the Association from his state or service.

PARLIAMENTARY USAGE.

3. Cushing's Law and Practice of Legislative Assemblies shall be the guide of parliamentary practice until otherwise ordered.

PAPERS.

4. Papers to be presented at a general session of the Association shall be in the hands of the Secretary of the Association not less than twenty days before the coming meeting, and to be printed in the transactions in full or in abstract at the discretion of the Publication Committtee.

5. All papers accepted by the Association, whether read in full, by abstract, by title, or filed, shall be delivered to the Secretary as soon as thus disposed of, as the exclusive property of the Association. Any paper presented to this Association and accepted by it shall be refused publication in the transactions of the Association, if it be published, in whole or in part, by permission or assent of its author, in any manner prior to the publication of the volume of transactions, unless written consent is obtained from the Publication Committee.

6. Day papers shall be limited to twenty minutes, and evening papers to thirty minutes each.

DISCUSSION OF PAPERS.

7. After the leading papers on each subject, as indicated by the Executive Committee, have been read, discussion shall follow, and be confined strictly to the subject of these papers; and each speaker shall be limited to ten minutes, and shall not speak a second time until after every other member who desires to be heard, and then only for five minutes, except by unanimous consent.

8. The Chair shall notify gentlemen who desire to speak to send up their names, and they shall be called on in the order sent up; and he may, at his discretion, limit the time of speaking to five instead of ten minutes, if in his judgment it may become necessary to do so in order to allow each one on the list an opportunity to be heard.

PUBLICATION COMMITTEE.

9. The Publication Committee shall consist of a Chairman, the Secretary of the Association, the Treasurer of the Association, and a member of each section of the Association, with the President of the Association *ex officio*.

10. Unless otherwise ordered by the Association, such committee is hereby instructed to keep the size of the annual transactions within the limits of four hundred pages; and to this end to conform to the several following rules:

a. Make summaries of such local and other addresses as are not of permanent scientific value.

b. The Chairman of the several Standing Committees shall be notified by the Secretary that the reports to be presented by them shall include any material prepared by the several members of their committees and must be in the hands of the Publication Committee not later than thirty days before the succeding annual meeting for preliminary printing.

c. Such reports shall be printed for distribution to the members on registering at the coming meeting; but no report shall be printed unless in the hands of the Publication Committee, as specified above.

11. The Publication Committee shall procure a copyright on the transactions in the name of the Association, and the committee shall have full charge of the publication of the transactions.

APPLICATION FOR MEMBERSHIP.

12. All applications for membership must be made upon the application blank of the Association.

13. Persons not members, having prepared papers to be presented at the meetings of the Association, shall be proposed for membership at the first business meeting of the Association.

EXPENDITURES.

14. All bills connnected with the publication of the transactions shall, upon the approval of the chairman of the Publication Committee and the Secretary, be signed by the president of the Association, and paid by check of the Treasurer directly to the party concerned; and the President shall not approve any bill, relating either

to publishing or printing, without the approval first of the chairman of the committee in charge thereof.

15. Bills for current expenses shall be first approved by the Secretary, then sent to the President, and on his approval they shall be paid by check of the Treasurer directly to the parties interested.

16. The actual and necessary traveling expenses of the Secretary and Treasurer to the annual meeting of the Association, and to one meeting of the Executive Committee, shall be classed as current expenses.

RESOLUTIONS.

17. All resolutions presented to the Association shall be sent to the Chair in writing, and referred to a committee without discussion.

ARREARAGES.

18. The arrearages of all members remitting their dues for two years shall be cancelled up to the date of the last payment, but they shall be entitled to the transactions of the Association only for the years for which they have actually paid.

AUDITING COMMITTEE.

19. An Auditing Committee shall be appointed by the Chair to audit the accounts of the Treasurer, and report upon the same.

OFFICERS AND COMMITTEES

OF THE

AMERICAN PUBLIC HEALTH ASSOCIATION.

OFFICERS, 1900–1901.

President..... Dr. Benjamin Lee, Philadelphia, Pa.
First Vice-President.....Rudolph Hering, C. E., New York, N. Y.
Second Vice-President.....Dr. John N. Hurty, Indianapolis, Ind.
Secretary.....Dr. Charles O. Probst, Columbus, O.
Treasurer.....Dr. Henry D. Holton, Brattleboro, Vt.

PRESIDENTS OF THE ASSOCIATION.

Stephen Smith, M. D.....1872, '73, '74
*Joseph M. Toner, M. D..... 1875
*Edwin M. Snow, M. D..... 1876
*John H. Rauch, M. D..... 1877
*Elisha Harris, M. D..... 1878
*James L. Cabell, M. D..... 1879
John S. Billings, M. D..... 1880
*Charles B. White, M. D..... 1881
Robert C. Kedzie, M. D..... 1882
*Ezra M. Hunt, M. D..... 1883
Albert L. Gihon, M. D..... 1884
*James E. Reeves, M. D..... 1885
Henry P. Walcott, M. D..... 1886
George M. Sternberg, M. D..... 1887
Charles N. Hewitt, M. D..... 1888
*Hosmer A. Johnson, M. D..... 1889
Henry B. Baker, M. D..... 1890
Frederick Montizambert, M. D..... 1891
Felix Formento, M. D..... 1892
Samuel H. Durgin, M. D..... 1893
Emmanuel P. Lachapelle, M. D..... 1894
William Bailey, M. D..... 1895
Eduardo Licéaga, M. D..... 1896
Henry B. Horlbeck, M. D..... 1897
C. A. Lindsley, M. D..... 1898
*George H. Rohé, M. D..... 1899
Henry Mitchell, M. D..... 1899
Peter H. Bryce, M. D..... 1900

*Deceased.

EXECUTIVE COMMITTEE.

(The officers and ex-Presidents are *ex-officio* members of the Executive Committee.)

Dr. JOHN L. LEAL..... Paterson, N. J.
Dr. C. P. WILKINSON..... New Orleans, La.
Dr. J. F. KENNEDY..... Des Moines, Ia.
Dr. A. WALTER SUITER..... Herkimer, N. Y.
Dr. JESUS CHICO..... Guanajuato, Mex.
Mr. CROSBY GRAY..... Pittsburg, Pa.

PUBLICATION COMMITTEE.

Dr. J. N. MCCORMACK.....Bowling Green, Ky.
Dr. C. O. PROBST.....Columbus, O.
Dr. H. D. HOLTON.....Brattleboro, Vt.
Dr. ADOLPH GEHRMANN.....Chicago, Ill.

(The President, *ex officio.*)

ADVISORY COUNCIL.

UNITED STATES:

Alabama.....
Arkansas.....
California.....
Colorado.....
Connecticut..... Dr. FRANK W. WRIGHT, *New Haven.*
Delaware..... W. C. R. COLQUHOUN, *Wilmington.*
Florida.....
Georgia.....
Illinois..... Dr. ADOLPH GEHRMANN, *Chicago.*
Indiana..... Dr. J. N. HURTY, *Indianapolis.*
Iowa..... Dr. C. H. PRESTON, *Davenport.*
Kansas.....
Kentucky..... Dr. WILLIAM BAILEY, *Louisville.*
Louisiana..... Dr. C. P. WILKINSON, *New Orleans.*
Maine..... Prof. FRANKLIN C. ROBINSON, *Brunswick.*
Maryland..... Dr. C. H. JONES, *Baltimore.*
Massachusetts..... Dr. S. H. DURGIN, *Boston.*
Michigan..... Dr. C. L. WILBUR, *Lansing.*
Minnesota..... Dr. F. F. WESBROOK, *Minneapolis.*
Mississippi.....
Missouri..... Dr. AMAND RAVOLD, *St. Louis.*
Nebraska.....
New Hampshire..... Dr. WM. K. ROBBINS, *Manchester.*
New Jersey..... Dr. JOHN LAINY LEAL, *Paterson.*
New Mexico.....
New York..... Dr. A. WALTER SUITER, *Herkimer.*
North Carolina..... Dr. S. W. BATTLE, *Asheville.*
North Dakota..... Dr. H. D. QUARRY, *Grand Forks.*
Ohio..... Dr. W. T. GEMMILL, *Forest.*
Oklahoma Territory....
Pennsylvania..... Mr. CROSBY GRAY, *Pittsburg.*
Rhode Island..... Dr. GARDNER T. SWARTS, *Providence.*

South Carolina..... Dr. H. B. Horlbeck, *Charleston.*
South Dakota.....
Tennessee.....
Texas..... Dr. John Hicks Florence, *Dallas.*
Vermont..... Dr. Henry D. Holton, *Brattleboro.*
Virginia.....
Washington..... Dr. James B. Eagleson, *Seattle.*
West Virginia.....
Wisconsin..... Dr. Uranus O. B. Wingate, *Milwaukee.*
District of Columbia... Dr. William C. Woodward, *Washington, D. C.*
U. S. Army..... Dr. Walter Reed, *Washington, D. C.*
U. S. M. H. Service... Dr. R. M. Woodward, *Washington, D. C.*
U. S. Navy..... Dr. T. J. Turner, *Coldwater, Mich.*

Canada:

Dominion of Canada... Dr. Frederick Montizambert, *Ottawa.*
Province of Ontario... Dr. J. A. Amyot, *Toronto.*
Province of Quebec.... Dr. E. P. Lachapelle, *Montreal.*
Manitoba..... Dr. Jno. A. Macdonald, *Brandon.*
New Brunswick.....
Nova Scotia.....

Mexico:

Aguas Calientes..... Dr. Ysmael Prieto, *Mexico, D. F.*
Campeche..... Dr. Domingo Orvanaños, *Mexico, D. F.*
Colima.....
Coahulia..... Dr. David Cerna, *Saltillo.*
Chihuahua..... Dr. Miguel Marquez, *Chihuahua.*
Chiapas.....
Durango..... Dr. Jose L. Gomez, *Mexico, D. F.*
Guanajuato..... Dr. Jésus Chico, *Guanajuato.*
Guerrero.....
Hidalgo.....
Jalisco..... Dr. Salvador Garcia Diego, *Guadalajara.*
Michoacán..... Dr. Manuel Gutierrez, *Queretaro.*
Morelos..... Dr. Fernando Lopez, *Mexico, D. F.*
Mexico..... Dr. Ignacio Guzman, *Toluca.*
Nuevo León.....
Oaxaca..... Dr. Francisco Bernaldez, *Mexico, Mex.*
Puebla..... Dr. Nicolas R. de Arellano, *Mexico, D. F.*
Querètaro..... Dr. Manuel Septien, *Queretaro.*
San Luis Potosi..... Dr. Jésus E. Monjarás, *San Luis Potosi.*
Sonora.....
Sinaloa.....
Tabasco.....
Tamaulipas..... Dr. Antonio Matienzo, *Tampico.*
Tlaxcala.....
Veracruz..... Dr. Manuel Iglesias, *Veracruz.*
Yucatan..... Dr. Adolf Patron Martinez, *Merida.*
Zacatecas..... Dr. Juan Breña, *Zacatecas.*
Territorio de la Baja Calif.
Territorio de Tepic.....
Distrito Federal..... Dr. Eduardo Licéaga, *Mexico, D. F.*

STANDING COMMITTEES.

POLLUTION OF PUBLIC WATER SUPPLIES.

George W. Fuller, Esq.....New York City.
Dr. Wyatt Johnston.....Montreal, P. Q.
Dr. José Ramirez.....Mexico, D. F.
Dr. A. C. Abbott.....Philadelphia, Pa.
Dr. John L. Leal.....Paterson, N. J.
Dr. Josiah Hartzell.....Canton, Ohio.
Dr. L. P. Kinnicutt.....Worcester, Mass.
Allen Hazen, C. E.....New York City.
Robert Spurr Weston, C. E.....Boston, Mass.
Dr. J. J. Mackenzie.....Toronto, Ont.
Dr. F. F. Wesbrook.....Minneapolis, Minn.
Rudolph Hering, C. E.....New York City.
F. Herbert Snow, C. E.....Columbus, O.
Jno. W. Alvord, C. E.....Chicago, Ill.
Geo. H. Benzenberg, C. E.....Milwaukee, Wis.
Dr. U. O. B. Wingate.....Milwaukee, Wis.
F. H. Newell, C. E.....Washington, D. C.

DISPOSAL OF REFUSE MATERIALS.

Rudolph Hering, C. E.....New York City.
Charles A. Meade.....New York City.
Dr. Jules Chapin.....Montreal, P. Q.
Dr. Manuel Iglesias.....Veracruz, Mex.
Dr. Hibbert W. Hill.....Boston, Mass.
Dr. W. C. Woodward.....Washington, D. C.

ANIMAL DISEASES AND ANIMAL FOOD.

D. E. Salmon, D. V. M.....Washington, D. C.
Dr. M. P. Ravenel.....Philadelphia, Pa.
Prof. José L. Gomez.....Mexico, D. F.
Dr. Henry M. Bracken.....Minneapolis, Minn.
Dr. Jno. A. Macdonald.....Brandon, Mani.
J. I. Gibson, D. V. S.....Denison, Iowa.
Dr. Irving A. Watson.....Concord, N. H.
Dr. V. A. Moore.....Ithaca, N. Y.

CAR SANITATION.

Prof. S. H. Woodbridge.....Boston, Mass.
Dr. John N. Hurty.....Indianapolis, Ind.
Dr. Granville P. Conn.....Concord, N. H.
Dr. Domingo Orvanaños.....Mexico, Mex.
Dr. Elzear Pelletier.....Montreal, P. Q.

ETIOLOGY OF YELLOW FEVER.

Dr. H. B. Horlbeck.....Charleston, S. C.
Dr. C. P. Wilkinson.....New Orleans, La.

Dr. Eduardo Licéaga.....Mexico, D. F.
Dr. Walter Reed.....Washington, D. C.
Dr. Walter Wyman, U. S. M. H. S.....Washington, D. C.
Dr. Alvah H. Doty.....Quarantine, S. I.
Dr. J. J. Kinyoun, M. H. S.....Washington, D. C.

STEAMSHIP AND STEAMBOAT SANITATION.

Dr. Frederick Montizambert.....Ottawa, Ont.
Dr. S. H. Durgin.....Boston, Mass.
Med. Dir. Albert L. Gihon.....New York City.
Mr. Geo. C. Whipple.....Brooklyn, N. Y.
Dr. Alvah H. Doty.....New York City.
Dr. C. P. Wilkinson.....New Orleans, La.
Dr. C. Hampson Jones.....Baltimore, Md.

RELATION OF FORESTRY TO THE PUBLIC HEALTH.

Prof. Wm. H. Brewer.....New Haven, Conn.
Prof. H. S. Graves.....New Haven, Conn.
Dr. Juan Breña.....Zacatecas, Mex.
Dr. Byron Stanton.....Cincinnati, Ohio.
Dr. E. L. Trudeau.....Saranac Lake, N. Y.
Dr. P. H. Bryce.....Toronto, Ont.

DEMOGRAPHY AND STATISTICS IN THEIR SANITARY RELATION.

[Uniform Municipal Statistics referred to this Committee.]

Dr. John S. Fulton.....Baltimore, Md.
Dr. Samuel W. Abbott.....Boston, Mass.
Dr. Charles V. Chapin.....Providence, R. I.
Dr. H. M. Bracken.....St. Paul, Minn.
Dr. Cressy L. Wilbur.....Lansing, Mich.
Dr. Wm. H. Welch.....Baltimore, Md.
Mr. M. N. Baker.....New York, N. Y.
Dr. Wm. C. Woodward.....Washington, D. C.

CAUSE, PREVENTION AND DURATION OF INFECTIOUS DISEASES.

Dr. A. Walter Suiter.....Herkimer, N. Y.
Sur.-Gen. Geo. M. Sternberg, U. S. A.....Washington, D. C.
Dr. Jésus E. Monjarás.....San Luis Potosi, Mex.
Dr. W. C. Woodward.....Washington, D. C.
Dr. Frank W. Wright.....New Haven, Conn.
Dr. J. F. Kennedy.....Des Moines, Iowa.
Dr. A. R. Reynolds.....Chicago, Ill.
Dr. S. W. Battle.....Asheville, N. C.

PUBLIC HEALTH LEGISLATION.

Dr. U. O. B. Wingate.....Milwaukee, Wis.
Dr. Henry P. Walcott.....Cambridge, Mass.
Dr. Henry D. Holton.....Brattleboro, Vt.
Dr. C. O. Probst.....Columbus, Ohio.
Dr. A. H. Doty.....New York, N. Y.
Dr. H. B. Horlbeck.....Charleston, S. C.

Dr. C. P. Wilkinson.....New Orleans, La.
Dr. A. R. Reynolds.....Chicago, Ill.
Dr. J. N. Hurty.....Indianapolis, Ind.
Dr. J. N. McCormack.....Bowling Green, Ky.

CAUSE AND PREVENTION OF INFANT MORTALITY.

Dr. Ernest Wende.....Buffalo, N. Y.
Dr. W. K. Jaques.....Chicago, Ill.
Dr. J. A. Amyot.....Toronto, Ont.
Dr. J. E. Monjarás.....San Luis Potosi, Mex.

DISINFECTANTS AND DISINFECTION.

Prof. Franklin C. Robinson.....Brunswick, Me.
Dr. Hibbert W. Hill.....Boston, Mass.
Dr. E. A. de Schweinitz.....Washington, D. C.
Dr. Alvah H. Doty.....New York City.
Dr. Adolph Gehrmann.....Chicago, Ill.
Mr. E. G. Horton.....Columbus, Ohio.
Dr. Wyatt Johnston.....Montreal, P. Q.
Prof. L. P. Kinnicutt.....Worcester, Mass.
Dr. H. D. Pease.....Buffalo, N. Y.
Dr. M. P. Ravenel.....Philadelphia, Pa.
Dr. Amand Ravold.....St. Louis, Mo.
Dr. E. K. Sprague.....Washington, D. C.
Dr. E. H. Wilson.....Brooklyn, N. Y.
Dr. R. E. Lyons.....Bloomington, Ind.
Dr. J. A. Amyot.....Toronto, Ont.
Prof. Severance Burrage.....Lafayette, Ind.
Dr. F. Lopez.....Mexico, D. F.
Dr. F. C. Suiter.....LaCrosse, Wis.

ON NATIONAL LEPER HOME.

Dr. H. M. Bracken.....Minneapolis, Minn.
Dr. F. Montizambert.....Ottawa, Can.
Dr. Jésus Chico.....Guanajuato, Mex.
Dr. Henry B. Horlbeck.....Charleston, S. C.
Dr. C. P. Wilkinson.....New Orleans, La.

ON DANGERS TO THE PUBLIC HEALTH FROM ILLUMINATING AND FUEL GAS.

Dr. Samuel H. Durgin.....Boston, Mass.
William Paul Gerhard, C. E.....New York City.
Mr. J. W. Hughes.....Montreal, P. Q.

TRANSPORTATION OF DISEASED TISSUE BY MAIL.

Dr. F. F. Wesbrook.....Minneapolis, Minn.
Dr. Jno. S. Fulton.....Baltimore, Md.
Dr. J. A. Amyot.....Toronto, Ont.
Dr. Henry Mitchell.....Trenton, N. J.
Dr. Geo. E. Tyler.....Denver, Col.
Dr. Domingo Orvanaños.....Mexico, D. F.
Dr. Henry D. Holton.....Brattleboro, Vt.
Dr. Walter Wyman.....Washington, D. C.

THE TEACHING OF HYGIENE AND GRANTING OF DIPLOMA OF DOCTOR OF PUBLIC HEALTH.

Prof. W. T. Sedgwick.....Boston, Mass.
Dr. C. O. Probst.....Columbus, Ohio.
Dr. Wyatt Johnston (Secretary).....Montreal, P. Q.
Dr. A. C. Abbott.....Philadelphia, Pa.
Prof. F. C. Robinson.....Brunswick, Me.
Prof. Severance Burrage.....Lafayette, Ind.
Dr. M. P. Ravenel.....Philadelphia, Pa.
Dr. C. H. Jones.....Baltimore, Md.
Dr. A. Walter Suiter.....Herkimer, N. Y.

SCHOOL HYGIENE.

Dr. Henry Mitchell.....Trenton, N. J.
Dr. Frank W. Wright.....New Haven, Conn.
Dr. U. O. B. Wingate.....Milwaukee, Wis.
Dr. J. F. Kennedy.....Des Moines, Iowa.
Dr. A. G, Young.....Augusta, Me.
Dr. C. Hampson Jones.....Baltimore, Md.
Dr. José Ramirez.....Mexico, Mex.
Dr. Henry J. Barnes.....Boston, Mass.
Dr. Daniel Lewis.....New York City.

COMMITTEE ON SANITARY AID SOCIETIES.

Dr. Geo. W. Goler.....Rochester, N. Y.
Miss Hester McClung.....Indianapolis, Ind.
Dr. E. Pelletier.....Montreal, P. Q.
Mr. Henry Lomb.....Rochester, N. Y.

SECTION OF BACTERIOLOGY AND CHEMISTRY.

OFFICERS AND COMMITTEES, 1900-1901.

Chairman.....Dr. Wyatt Johnston, Montreal, P. Q.
Vice-Chairman.....Dr. E. O. Jordan, Chicago, Ill.
Secretary.....Mr. Geo. C. Whipple, Brooklyn, N. Y.
Recording Secretary.....Dr. H. D. Pease, Buffalo, N. Y.

COUNCIL.

Dr. Theobald Smith.....Boston, Mass.
Dr. W. R. Stokes.....Baltimore, Md.
Dr. A. C. Abbott.....Philadelphia, Pa.
Dr. V. A. Moore.....Ithaca, N. Y.
Dr. E. A. de Schweinitz.....Washington, D. C.

LOCAL CHAIRMAN OF SECTION ARRANGEMENTS.

Dr. Wm. G. Bissell.....Buffalo, N. Y.

GENERAL ADVISORY COMMITTEE.

[The retiring Officers and Council, *ex officio.*]

[Chairmen have authority to select associates.]

ON STANDARD METHODS OF WATER ANALYSIS.

George W. Fuller.....New York, N. Y.
George C. Whipple.....Brooklyn, N. Y.
Harry W. Clark.....Boston, Mass.
Adolph Gehrmann, M. D.....Chicago, Ill.
Wyatt Johnston, M. D.....Montreal, P. Q.
E. O. Jordan, Ph. D.....Chicago, Ill.
H. L. Russell, Ph. D.....Madison, Wis.

BACTERIOLOGY OF MILK IN ITS SANITARY RELATIONS.

H. L. Russell.....Madison, Wis.
W. H. Conn.....Middletown, Conn.
R. G. Freeman, M. D.....New York, N. Y.

VARIATIONS OF THE COLON BACILLUS IN RELATION TO PUBLIC HEALTH.

Veranus A. Moore, M. D.....Ithaca, N. Y.
J. G. Adami, M. D.....Montreal, P. Q.
Elmer G. Horton.....Columbus, O.
Jésus E. Monjarás, M. D.....San Luis Potosi, Mex.

EXHIBITION OF LABORATORY APPARATUS AND APPLIANCES FOR TEACHING HYGIENE.

Dr. W. G. Bissell.....Buffalo, N. Y.

REVISED LIST OF MEMBERS

AMERICAN PUBLIC HEALTH ASSOCIATION.

1900.

This list includes those who have maintained their membership to the present time, counting those joining in 1900. The Secretary should be notified of any errors or omissions.

MEMBERS.

Abbott, Samuel W., M. D.	Wakefield, Mass.	1882
Abbott, Alex C., M. D.	University of Pennsylvania, Philadelphia, Pa.	1897
Adams, Charles Everett, M. D.	29 W. Broadway, Bangor, Me.	1894
Adams, J. F. A., M. D.	Pittsfield, Mass.	1881
Addy, G. B.	St. John, N. B.	1899
Alden, C. H., U. S. A.	Newtonville, Mass.	1887
Alexander, Edward, M. D.	El Paso, Tex.	1892
Allen, Kenneth, C. E.	Equitable Building, Baltimore, Md.	1899
Allen, Thomas G., M. D.	439 Elk St., Buffalo, N. Y.	1896
Allen, Wm. Harvey.	University of Pennsylvania, Philadelphia, Pa.	1899
Alvarez, Maximilian, M. D.	Toluca, Mex.	1896
Alvord, J. W., C. E.	127 Hartford Building, Chicago, Ill.	1899
Anderson, B. P., M. D.	Colorado Springs, Col.	1895
Anders, H. S., M. D.	1836 Wallace St., Philadelphia, Pa.	1897
Aquiloz, Ponciano, C. E.	Guanajuato, Mex.	1897
Atwood, James W.	1632 Arch St., Philadelphia, Pa.	1897
Atkinson, Edward, Hon.	Boston, Mass.	1889
Ayala, Melchor, Sr.	Guanajuato, Mex.	1896
Baca, Francisco Martinez, M. D.	Puebla, Puebla, Mex.	1892
Bacon, Morgan L., M. D.	Main St., Wellsboro, Pa.	1896
Bailey, Alfred W., M. D.	Atlantic City, N. J.	1899
Bailey, William, M. D.	Louisville, Ky.	1879
Bailey, William C., M. D.	614 Walnut St., Las Vegas, N. M.	1892
Bailhache, P. H., M. D., U. S. M. H. S.	Stapleton, N. Y.	1874
Baldwin, E. R., M. D.	Saranac Lake, N. Y.	1899
Barcena, Mariano, Sr.	Mexico, Mex.	1892
Barnes, Henry Jabez, M. D.	429 Beacon St., Boston, Mass.	1896
Bartlett, James W.	Dover, N. H.	1888
Bartley, Elias Hudson, M. D.	21 Lafayette Ave., Brooklyn, N. Y.	1890
Bashore, Harvey B., M. D.	West Fairview, Pa.	1897
Battle, Samuel W., M. D., U. S. A.	Asheville, N. C.	1887
Beard, Richard O., M. D.	Minneapolis, Minn.	1899
Beaudrey, J. A., M. D.	65 St. Denis St., Montreal, P. Q.	1889
Beckwith, D. H., M. D.	94 Dorchester Ave., Cleveland, Ohio.	1884
Beebe, Henry E., M. D.	Sidney, Ohio.	1882
Belcourt, Napoleon Antoine, Esq.	Ottawa, Ont.	1898

Bell, A. N., M. D.....337 Clinton St., Brooklyn, N. Y. 1872
Bell, Gordon, M. D.....Winnipeg, Manitoba. 1899
Benitz, J. M., M. D.....Guadalajara, Jalisco, Mex. 1892
Bergey, David H., M. D.....34th and Locust Sts., Philadelphia, Pa. 1894
Bernaldez, Francisco, M. D.....Estampa-Merced 5, Mexico, Mex. 1892
Beshoar, Michael, M. D.....Trinidad, Col. 1895
Bishop, William T., M. D.....Harrisburg, Pa. 1889
Black, William G.....Ottawa, Ont. 1897
Blackwell, Emily, M. D.....53 E. 20th St., New York City. 1873
Boardman, Wm. Frears.....Ottawa, Ont. 1898
Board of Health.....Erie, Pa. 1899
Board of Health.....Manchester, N. H. 1899
Bostwick, W.....Ottawa, Ont. 1898
Bracken, Henry Martyn, M. D.....1010 4th St., Minneapolis, Minn. 1895
Brackett, C. F., M. D.....Princeton, N. J. 1899
Bradley, A. E., M. D.....Washington, D. C. 1899
Braunnagel, Julius, M. D.....Box 925, San Antonio, Tex. 1890
Brava, Carlos, M. D.....Colimo, Mex. 1896
Bray, Charles W., M. D.....Portland, Me. 1894
Breña, Juan, M. D.....Zacatecas, Mex. 1898
Brewer, Prof. William H., M. D.....New Haven, Conn. 1874
Briggs, Alexander B., M. D.....Ashaway, R. I. 1895
Brown, Edward J., M. D.....Minneapolis, Minn. 1899
Brown, Joseph O.....Pittsburg, Pa. 1888
Brumbaugh, Gaius M., M. D.....904 Mass. Ave., Washington, D. C. 1896
Bryce, Peter H., M. D.....Toronto, Ont. 1883
Buck, Erastus J., M. D.....Platteville, Wis. 1888
Burn, George.....Ottawa, Ont. 1898
Burns, R. G., M. D.....72 Ohio St., Allegheny, Pa. 1897
Burrage, Severance, S. B.....Lafayette, Ind. 1897
Burroughs, Jas. A., M. D.....Asheville, N. C. 1898
Buxton, L. Haynes, M. D.....Oklahoma City, O. T. 1897

Cabana, Louis V., M. D.....Fall River, Mass. 1898
Cameron, Allen, M. D.....Owen Sound, Ont. 1886
Cameron, J. Chalmers, M. D.....941 Dorchester St., Montreal, P. Q. 1894
Campos, Juan N., M. D.....Toluca, Mex. 1899
Carel, H. C.....Minneapolis, Minn. 1899
Carmona, Luis S., M. D.....Mexico, Mex. 1896
Carmona y Valle, Manuel, M. D.....Mexico, Mex. 1892
Caverly, Charles S., M. D.....Rutland, Vt. 1894
Cerna, David, M. D.....Galveston, Tex. 1896
Chacon, Augustin, M. D.....Ortega 10, Mexico, Mex. 1892
Chaillé, Prof. Stanford E.....P. O. Drawer 261, New Orleans, La. 1874
Chandler, Prof. C. F.....Columbia College, New York City. 1872
Chandler, David D.....74 No. 7th St., Newark, N. J. 1896
Chapin, Charles V., M. D.....Providence, R. I. 1886
Chase, Herman L., M. D.....Brookline, Mass. 1895
Chase, John C., C. E.....Derry, N. H. 1890
Chester, F. D.....Path. and Bact. Lab., Newark, Del. 1899
Chico, Jésus, M. D...2 Estrella St., Guanajuato City, Guanajuato, Mex. 1891
Church, C. R., M. D.....Ottawa, Ont. 1898

Church, Thomas Teasdale, M. D.	70 E. Main St., Salem, Ohio.	1890
Clark, Harry W.	State House, Boston, Mass.	1896
Clarke, A. P., M. D.	825 Mass. Ave., Cambridge, Mass.	1887
Clark, J. Fred, M. D.	Fairfield, Ia.	1899
Cluff, Wm. H.	Ottawa, Ont.	1898
Coffey, James C.	Worcester, Mass.	1896
College of Medicine.	Syracuse University, Syracuse, N. Y.	1899
Collins, C. S., M. D.	Nashua, N. H.	1896
Colquhoun, W. C. R.	Wilmington, Del.	1894
Columbus Medical Library.	Columbus Memorial Bldg., Chicago, Ill.	1897
Comegys, J. P., M. D.	Rock Island, Ill.	1897
Conn, G. P., M. D.	Concord, N. H.	1875
Connell, Walter Thomas, M. D.	Kingston, Ont.	1898
Connelly, R. N., M. D.	Newark, N. J.	1898
Conniff, Robert E., M. D.	Sioux City, Iowa.	1897
Conner, P. S., M. D.	Cincinnati, Ohio.	1884
Constantineau, Rev. J. A.	Ottawa, Ont.	1898
Contreras, Angel, M. D.	Mesones 7, Puebla, Puebla, Mex.	1892
Cook, Richard J.	316 Chestnut St., Philadelphia, Pa.	1897
Cooke, S. P., M. D.	Ottawa, Ont.	1898
Coplin, William L.	1419 So. Broad St., Philadelphia, Pa.	1897
Corlett, J. F., M. D.	Minneapolis, Minn.	1899
Cornell University.	Ithaca, N. Y.	1897
Craig, G. G., M. D.	Rock Island, Ill.	1880
Craven, Macdonough, C. E.	263 82d St., Brooklyn, N. Y.	1899
Cross, J. James R., C. E.	68 Broad St., New York City.	1877
Currier. David M., M. D.	Newport, N. H.	1883
Curtis, George Francis, M. D.	West Newton, Mass.	1897
Curtis, F. C., M. D.	Albany, N. Y.	1883
Dalby, William Thomas, M. D.	Salt Lake City, Utah.	1894
Daniell, R. P., M. D.	Jacksonville, Fla.	1890
Davis, Floyd, Ph. D.	Des Moines, Iowa.	1890
Davis, N. S.. M. D.	65 Randolph St., Chicago, Ill.	1887
Deery, J., M. D.	Betz Building, Philadelphia, Pa.	1897
de Garay, Adrian, M. D.	Mexico, Mex.	1892
de la Garza, Juan F., M. D.	Laredo, Tamaulipas, Mex.	1896
de la Roché, C. P., M. D.	1518 Pine St., Philadelphia, Pa.	1897
del Rio, Narciso, M. D.	Veracruz, Mex.	1899
Dennis, Laban, M. D.	30 Central St., Newark, N. J.	1877
Derby, William P., M. D.	66 Bacon St., Boston, Mass.	1896
de Schweinitz, Emil A., M. D.	Washington, D. C.	1896
DeWitt, C., M. D.	Fort Monroe, Va.	1895
Disbrow, Wm. S., M. D.	Newark, N. J.	1899
Dinsmor, S. M., M. D.	Keene, N. H.	1896
Dodge, William E., Jr.	11 Cliff St., New York City.	1874
Doty, Alvah H., M. D.	Quarantine, Staten Island, N. Y.	1896
Doyle, Gregory, M. D.	307 W. Genesee St., Syracuse, N. Y.	1896
Doyle, William H., M. D.	1610 Spruce St., Philadelphia, Pa.	1897
Drew, Charles W., M. D.	505 Century Bldg., Minneapolis, Minn.	1899
Drown, Thomas M., M. D.	South Bethlehem, Pa.	1887
Dudley, Charles P., M. D.	Altoona, Pa.	1888

Dunham, E. K., M. D.....338 26th St., New York City. 1897
Dunmire, G. B., M. D.....1618 Spruce St., Philadelphia, Pa. 1897
Durgin, Samuel H., M. D.....12 Beacon St., Boston, Mass. 1875

Eagleson, James B., M. D.....Burke Building, Seattle, Wash. 1896
Edson, P. O'M., M. D.....249 Warren St., Boston, Mass. 1895
Egan, J. A., M. D.....Springfield, Ill. 1897
Ellms, J. W.....East Court and Martin Sts., Cincinnati, Ohio. 1897
Ellegood, R. G., M. D.....Concord, Del. 1897
Elsner, John, M. D.....Denver, Col. 1887
Emerson, H. C., M. D.....Springfield, Mass. 1899
Emery, Z. Taylor, M. D.....831 Washington Ave., Brooklyn, N. Y. 1894
Emmert, Joseph M., M. D.....Atlantic, Iowa. 1897
Enright, I. C.....Ottawa, Ont. 1898
Ernst, Harold C., M. D.....Harvard Medical School, Boston, Mass. 1899
Exton, James A., M. D.....75 Beech St., Arlington, N. J. 1897

Fales, Frank L., C. E.....City Hall, Cincinnati, Ohio. 1893
Farnham, Edwin, M. D.....Cambridge, Mass. 1889
Farquar, A. B., Esq.....York, Pa. 1880
Fenton, Thomas H., M. D.....1319 Spruce St., Philadelphia, Pa. 1897
Ferguson, F., M. D.....20 W. 38th St., New York City. 1892
Fernandez, J. D., M. D.....Jacksonville, Florida. 1890
Fleischmann, Louis, M. D.....788 Broadway, New York City. 1890
Flick, Lawrence F., M. D.....736 Pine St., Philadelphia, Pa. 1890
Florence, John H., M. D.....Dallas, Texas. 1899
Foote, Charles Jenkins, M. D.....26 Elm St., New Haven, Conn. 1895
Formento, Felix, M. D.....New Orleans, La. 1880
Foster, Eugene, M. D.....Augusta, Ga. 1881
Fowler, Joseph, M. D.....141 Delaware Ave., Buffalo, N. Y. 1896
Freeman, R. G., M. D.....478 W. 59th St., New York, N. Y. 1899
French, C. D., M. D.....Lawrenceville, Ill. 1897
Fries, Albert, M. D.....92 Reade St., New York City. 1897
Frost, Prof. Wm. D.....Madison, Wis. 1899
Fuller, George W.....220 Broadway, New York City. 1892
Fulton, John S., M. D.....10 South St., Baltimore, Md. 1897

Gable, Isaac C., M. D.....26 South St., York, Pa. 1897
Gayon, José P., M. D.....Mexico, Mex. 1897
Garciadiego, Salvador, M. D.....Guadalajara, Jalisco, Mex. 1892
Gauntt, Franklin, M. D.....Burlington, N. J. 1885
Gaviño, A., M. D.....Ratas No. 4, Mexico, Mex. 1891
Geddes, Mrs. Frederick L.....413 The Valentine, Toledo, Ohio. 1897
Gehrmann, Adolph, M. D.....3816 Ellis St., Chicago, Ill. 1895
Gerhard, William Paul, C. E.....36 Union Square, New York City. 1880
Gerrish, Frederic H., M. D.....Portland, Me. 1885
Gibson, J. I., V. S.....Denison, Iowa. 1898
Gihon, Albert L., M. D., U. S. N.....233 5th Ave., New York City. 1876
Gilbert, John, M. D.....Fall River, Mass. 1898
Goltra, John N., M. D.....441 Elmwood Ave., Buffalo, N. Y. 1896
Gomez, José L., M. D.....Mexico, Mex. 1899
Goodwin, R. S., M. D.....Thomaston, Conn. 1886
Gorham, Fred P.....Providence, R. I. 1899

GRANT, Sir JAMES, M. D.....Ottawa, Ont. 1898
GRAVES, E. E., M. D.....Penacook, N. H. 1886
GRAY, CROSBY .....Pittsburgh, Pa. 1874
GRAY, SAMUEL M., C. E.....10 Weybosset St., Providence, R. I. 1891
GREENE, MARY E., M. D.....Lawrence Ave., Charlotte, Mich. 1896
GREENE, WALTER D., M. D.....385 Jersey St., Buffalo, N. Y. 1896
GRIFFITH, JEFFERSON D., M. D.....Kansas City, Mo. 1891
GUTIERREZ, MANUEL, M. D.....13 Aduana Vieja, Mexico, Mex. 1891

HAGEY, JACOB MOYER, M. D.....Mt. Morris, N. Y. 1892
HAMILTON, J. H., M. D.....Richford, Vt. 1891
HANLEY, LAWRENCE G., M. D.....Seneca St., Buffalo, N. Y. 1896
HARRIS, NORMAN McL., M. D.....Baltimore, Md. 1899
HARRISON, GEORGE WOOD, M. D.....404 Second St., Ashland, Wis. 1896
HART, JAMES A., M. D.....802 N. Nevada Ave., Colorado Springs, Col. 1895
HARTZELL, JOSIAH, Ph. D.....Canton, Ohio. 1895
HASKELL, W. A., M. D.....Alton, Ill. 1883
HAZEN, ALLEN, C. E.....220 Broadway, New York City. 1892
HECKARD, M. O., M. D.....1251 W. Madison St., Chicago, Ill. 1897
HEFFRON, JOHN LORENZO, M. D.....448 S. Salina St., Syracuse, N. Y. 1894
HEKTOEN, LUDWIG, M. D.....Rush Medical College, Chicago, Ill. 1899
HENDERSON, ALEX. ALLAN, M. D.....Ottawa, Ont. 1898
HENGERER, WILLIAM .....Buffalo, N. Y. 1896
HERBERT, CHARLES P.....Champ de Mars St., Montreal, P. Q. 1894
HERING, RUDOLPH, C. E.....100 Williams St., New York City. 1878
HEROLD, H. C. H., M. D.....Newark, N. J. 1898
HEWITT, CHARLES N., M. D.....Red Wing, Minn. 1872
HICKS, CHARLES A., M. D.....Fall River, Mass. 1897
HILL, G. EVERETT.....156 Fifth Ave., New York City. 1897
HILL, HIBBERT W., M. D....Sudbury and Hawkins Sts., Boston, Mass. 1896
HILL, JOHN W., C. E.....35 Glenn Building, Cincinnati, Ohio. 1896
HISS, PHILIP H., Jr., M. D.....Washington Sq. No., New York, N. Y. 1899
HOGAN, LOUISE E.....75 W. 12th St., New York City. 1897
HOHENSCHUH, W. P.....Iowa City, Ia. 1899
HOLMES, A. MANSFIELD, M. D.....Denver, Col. 1899
HOLTON, HENRY D., M. D.....Brattleboro, Vt. 1875
HOOPER, WILLIAM G., M. D.....Atlantic City, N. J. 1896
HOPKINS, HENRY R., M. D.....433 Franklin St., Buffalo, N. Y. 1894
HORETZSKY, CHAS. G., C. E.....Toronto, Ont. 1898
HORLBECK, H. B., M. D.....Charleston, S. C. 1880
HORTON, ELMER G., B. S.....Columbus, Ohio. 1897
HOSKINS, HORACE D., D. V. S.....3452 Ludlow St., Philadelphia, Pa. 1897
HOWE, LUCIEN, M. D.....183 Delaware Ave., Buffalo, N. Y. 1896
HOYT, J. ELIZABETH, M. D.....85 North State St., Concord, N. H. 1895
HUDDLESTON, J. H., M. D.....126 W. 85th St., New York, N. Y. 1899
HUNT, A. CLARK, M. D.....Metuchen, N. J. 1888
HUNT, C. C., M. D.....Dixon, Ill. 1889
HUNT, SIMEON, M. D.....Warren Ave. and 2d St., E. Providence, R. I. 1896
HUNTER, CHAS. H., M. D.....13 Syndicate Block, Minneapolis, Minn. 1899
HURTY, JOHN N., M. D.....29 East Second St., Indianapolis, Ind. 1896
HUTCHINSON, HENRY, M. D.....St. Paul, Minn. 1899

Irwin, Fairfax, M. D.....410 Chestnut St., Philadelphia, Pa. 1897

Jackson, Daniel D.,
Flatbush Ave. and Eastern Parkway, Brooklyn, N. Y. 1899
Jackson, Edward, M. D.....1633 Locust St., Philadelphia, Pa. 1897
Jackson, Frank S., M. D.....Dunkirk, N. Y. 1896
Jacques, F. H.....Ottawa, Ont. 1898
James, Bushrod W., M. D...Cor. 18th and Green Sts., Philadelphia, Pa. 1878
Jenkins, William T., M. D.....New York, N. Y. 1892
Johnston, Wyatt, M. D.....76 Rue Ste. Gabriel, Montreal, P. Q. 1892
Johnson, Chas. B., M. D.....Champaign, Ill. 1897
Jones, C. Hampson, M. D.....211 W. Franklin St., Baltimore, Md. 1898
Jones, Leander P., M. D.....Greenwich, Conn. 1889
Jones, S. Case, M. D.....21 East Ave., Rochester, N. Y. 1895
Jones, S. S., M. D.....Frazee, Minn. 1899
Jordan, Edward C., C. E.....3½ Exchange St., Portland, Me. 1886
Jordan, E. O.....University of Chicago, Chicago, Ill. 1899

Kahle, R. D., M. D.....Lima, Ohio. 1898
Keefer, C. H., C. E.....Ottawa, Ont. 1896
Kellogg, J. H., M. D.....Battle Creek, Mich. 1878
Kelso, Wilbur M.....5833 Monroe Ave., Chicago, Ill. 1899
Kennedy, J. F., M. D.....Des Moines, Iowa. 1885
Karsner, Charles W., M. D.....1320 So. Broad St., Philadelphia, Pa. 1897
Kimball, James P., M. D., U. S. A.....Omaha, Neb. 1892
Kinnicutt, Leonard P., S. D.....Worcester, Mass. 1899
Kneass, S. S., M. D.....1510 Walnut St., Philadelphia, Pa. 1899
Knox, S. P. B., M. D.....912 Anacapa, Santa Barbara, Cal. 1892
Knox, William F., M. D.....McKeesport, Pa. 1887
Knopf, S. A., M. D.....N. W., 16 West 95th St., New York City. 1897
Kober, George M., M. D.....1600 T St., Washington, D. C. 1896
Kuichling, Emil, C. E.....Rochester, N. Y. 1882

Laberge, L., M. D.....Montreal, P. Q. 1899
Lachapelle, E. Persillier, M. D.....Montreal, P. Q. 1887
Lartigan, J., M. D.....478 W. 59th St., New York, N. Y. 1899
Leal, Alberto .....Guanajuato, Mex. 1897
Leal, John Lainy, M. D.....149 Ellison St., Paterson, N. J. 1891
Learned, John B., M. D.....Northampton, Mass. 1889
Lee, Benjamin, M. D.....1420 Chestnut St., Philadelphia, Pa. 1874
Leiter, L. Z., Esq.....P. O. Drawer L, Chicago, Ill. 1876
Leighton, Marshall.....Montclair, N. J. 1897
Lemp, William T.....St. Louis, Mo. 1884
Lewis, Daniel, M. D.....249 Madison Ave., New York City. 1894
Lewis, D. O., M. D.....1628 Market St., Philadelphia, Pa. 1897
Lewis, Francis W., M. D.....2016 Spruce St., Philadelphia, Pa. 1874
Lewis, Richard H., M. D.....Raleigh, N. C. 1892
Library of Pratt Institute.....Remsen St., Brooklyn, N. Y. 1897
Licéaga, Eduardo, M. D.....4 San Andres St., Mexico, Mex. 1891
Lilly, Josiah K.....Indianapolis, Ind. 1897
Lindsley, Charles A., M. D.....New Haven, Conn. 1875
Linsley, Jo. H., M. D.....Burlington, Vt. 1898

Lippert, Moritz, C. E.....Phoenixville, Pa. 1897
Loaiza, Rafael, M. D.....Tlaxcala, Mex. 1896
Logan, Geo., M. D.....Ottawa, Ont. 1898
Lorek, Thomas, M. D.....Zacatecas, Mex. 1895
Lumsden, Alexander .....Ottawa, Ont. 1898
Lumsden, W. J., M. D.....Elizabeth City, N. C. 1892

MacCabe, Jno. Alexander, LL. D.....Ottawa, Ont. 1898
McClellan, Ezra S., M. D.....Saranac Lake, N. Y. 1889
McClelland, J. H., M. D.....5th and Wilkins Ave., Pittsburg, Pa. 1885
McCormack, J. N., M. D.....Bowling Green, Ky. 1880
McFarland, Joseph, M. D.....1314 Franklin St., Philadelphia, Pa. 1897
Macfarlane, Thomas .....Ottawa, Ont. 1898
McGaillard, Benjamin, M. D.....229 East State St., Trenton, N. J. 1897
McKenzie, Thomas H., C. E.....Southington, Conn. 1893
McKlveen, John A., M. D.....Chariton, Ia. 1899
McNeil, J. Henry, M. D.....33 Sheboygan St., Fond du Lac, Wis. 1896
McShane, James Francis, M. D.,
2 So. Patterson Park Ave., Baltimore, Md. 1892
McTavish, D. B., Esq.....Ottawa, Ont. 1898
Mackenzie, John J., B. A.....Parliament Building, Toronto, Ont. 1894
Mackie, J. M., M. D.....Portage la Prairie, Manitoba. 1896
Macouzet, R., M. D.....Mexico, Mex. 1897
Marks, Solon, M. D.....Milwaukee, Wis. 1876
Marquardt, C. H., M. D.....La Crosse, Wis. 1893
Marquez, Miguel, M. D.....Chihuahua, Chihuahua, Mex. 1892
Marsh, E. J., M. D.....600 Park Ave., Paterson, N. J. 1872
Martinez, A. P., M. D.....Mérida, Mex. 1899
Mason, Robert S., M. D.....Chester, Pa. 1897
Mather, James .....Ottawa, Ont. 1898
Matienzo, Antonio, M. D.....Tampico, Mex. 1899
Matthews, W. E., M. D.....Johnstown, Pa. 1897
Meade, Charles Arthur.....303 E. 18th St., New York, N. Y. 1899
Mead, Daniel Webster, C. E.....1st Nat. Bank Bldg., Chicago, Ill. 1892
Mead, Julian Augustus, M. D.....Irving St., Watertown, Mass. 1896
Mendizabal, G., M. D.....Orizaba, Mex. 1893
Miller, Katherine, M. D.....Lincoln, Ill. 1892
Mitchell, Henry, M. D.....Asbury Park, N. J. 1886
Mitchell, W. C., M. D.....California Bldg., Denver, Col. 1899
Mohr, Charles, M. D.....1828 Green St., Philadelphia, Pa. 1897
Monjarás, Jésus E., M. D.....Cinco de Mayo, San Luis Potosi, Mex. 1891
Monjeau, C., C. E.....Middletown, Ohio. 1887
Montgomery, L. H., M. D.....92 State St., Chicago, Ill. 1879
Montizambert, Frederick, M. D.....Ottawa, Ont. 1885
Moore, Veranus A., M. D.....Veterinary College, Ithaca, N. Y. 1896
Morales, José Donaciano, M. D.,
Hospicio San Nicholes 13, Mexico, Mex. 1892
Morgan, David Percy.....Box 2036, New York City. 1885
Morris, John, M. D.....118 E. Franklin St., Baltimore, Md. 1874
Morris, Moreau, M. D.....109 E. 73d St., New York City. 1896
Morse, William F., S. E.....287 4th St., New York City. 1889
Mosher, Eliza M., M. D.....Ann Arbor, Mich. 1889

Muldoon, J., M. D.....San Juan Bautista, Tabasco, Mex. 1896
Mulford, Henry K.....412 So. 13th St., Philadelphia, Pa. 1896
Murray, Archibald, M. D.....145 Clinton St., Brooklyn, N. Y. 1899
Murray, Robert D., M. D., U. S. M. H. S.....St. Augustine, Fla. 1872

Nagle, John T., M. D.....13-21 Park Row, New York City. 1874
Nash, Herbert M., M. D.....Norfolk, Va. 1878
Neff, J. L., M. D.....Mutual Life Bldg., Philadelphia, Pa. 1897
Nesbitt, Beatty, M. D.....Toronto, Ont. 1897
Newell, F. H.....U. S. Geological Survey, Washington, D. C. 1897
Newman, G. A., M. D.....New London, Minn. 1899
Newton, Wm. K., M. D.....Paterson, N. J. 1883
New York Public Library.....40 Lafayette Place, New York, N. Y. 1898
New York State Library.....Albany, N. Y. 1897
Noriega, Alberto, M. D.....Hermosillo, Sonora, Mex. 1891
Noriega, Tomas, M. D.....Hospital de Jésus, Mexico, Mex. 1892
Norton, A. K., M. D.....Minneapolis, Minn. 1899
Nunn, R. J., M. D.....5 York St. East, Savannah, Ga. 1881
Nuttall, George H. F., M. D.,
Pathological Laby. New Museums, Cambridge, Eng. 1891

Ohage, Justus, M. D.....St. Paul, Minn. 1899
O'Hara, Michael, M. D.....31 South St., Philadelphia, Pa. 1897
Orton, John G., M. D.....Binghampton, N. Y. 1890
Orvanaños, Domingo, M. D.....25 Chavarria St., Mexico, Mex. 1890
Osborne, Edwin C., M. D.....49 Nassau St., Princeton, N. J. 1897
Otis, Edward Osgood, M. D..308 Commonwealth Ave., Boston, Mass. 1894

Paddock, Frank K., M. D.....Box 1183, Pittsfield, Mass. 1889
Park, Wm. H.....No. 315 W. 76th St., New York City. 1899
Parker, T. E., M. D.....Woodbury, N. J. 1897
Parmalee, Chas. L.....No. 35 Wall St., New York City. 1899
Parsons, William M., M. D.....Manchester, N. H. 1897
Patterson, James, M. D.....277 Donald St., Winnipeg, Manitoba. 1894
Pearson, Leonard, V. M. D.....Harrisburg, Pa. 1897
Pease, Herbert D., M. D.....238 Elmwood Ave., Buffalo, N. Y. 1897
Peck, George, M. D., U. S. N.....926 No. Broad St., Elizabeth, N. J. 1890
Pelletier, Elzéar, M. D.....Montreal, P. Q. 1892
Pennsylvania R. R. Relief Dept.....Trenton, N. J. 1899
Perkins, Jay, M. D.....Providence, R. I. 1899
Perry, Thomas B., M. D., P. A. Surgeon, U. S. M. H. S.,
San Francisco, Cal. 1896
Phelan, Thomas F., M. D.....Orange, N. J. 1897
Pierce, J. S.....Ardmore, Pa. 1897
Porter, Joseph Y., M. D.....Jacksonville, Fla. 1878
Poulin, Stanislas Remi, C. E.....Ottawa, Ont. 1898
Powell, Fred. Hamilton, M. D.....Ottawa, Ont. 1898
Pratt, Pascal P.....736 Main St., Buffalo, N. Y. 1896
Pray, Susan Remsen, M. D.....191 So. Ninth St., Brooklyn, N. Y. 1896
Preston, Charles, M. D.....Davenport, Ia. 1899
Preston, R. H., M. D.....Ottawa, Ont. 1898
Prieto, Ysmael, M. D.....Mexico, Mex. 1899

Probst, C. O., M. D.....Columbus, Ohio. 1886
Prudden, T. Mitchell, M. D.....437 W. 59th St., New York, N. Y. 1899

Quarry, H. D., M. D.....Grand Forks, N. D. 1899

Ramirez, José, M. D.....Plazuela Buena Vista 1626, Mexico, Mex. 1892
Ramirez, Roman, M. D.....Taculaye St., Mexico, Mex. 1898
Ravenel, M. P., M. D....University of Pennsylvania, Philadelphia, Pa. 1897
Ravenel, William C., M. D.....Charleston, S. C. 1890
Ravold, Amand, M. D.....St. Louis, Mo. 1897
Raymond, Joseph H., M. D.....L. I. College Hospital, Brooklyn, N. Y. 1882
Reed, Walter, M. D.....7 Cook Place, Washington, D. C. 1899
Repp, John J., V. M. D.....Ames, Ia. 1899
Reyes, Augustin, M. D.....Mexico, Mex. 1892
Reynolds, A. R., M. D.....City Hall, Chicago, Ill. 1893
Reynolds, M. H., V. M. D.....St. Anthony Park, Minn. 1899
Richards, Edgar.....341 W. 88th St., New York City. 1889
Richards, Mrs. E. H.....Institute of Technology, Boston, Mass. 1888
Richardson, Maj. Henry B., C. E.....New Orleans, La. 1880
Richardson, W. L., M. D.....225 Commonwealth Ave., Boston, Mass. 1875
Riddle, George, M. D.....Crystal City, Manitoba. 1895
Ripley, Martha G., M. D.....24 South 10th St., Minneapolis, Minn. 1899
Rives, William C., M. D.....1723 I St., Washington, D. C. 1885
Roberts, Charles F., M. D.....New York City. 1892
Robertson, Hon. James W.....Ottawa, Ont. 1898
Roberts, Hon. James A.....Mooney Building, Buffalo, N. Y. 1896
Robillard, Adolphe, M. D.....City Hall, Ottawa, Ont. 1896
Robin, Albert, M. D.....Newark, Del. 1899
Robinson, Prof. Franklin C.....Brunswick, Me. 1889
Robinson, John Franklin, M. D.....Manchester, N. H. 1894
Rogers, A. C., M. D.....Faribault, Minn. 1899
Russell, H. L.....Madison, Wis. 1899
Russell, Julia Wallace, M. D.....44 Pleasant St., Concord, N. H. 1892

Salmon, D. E., D. V. M.....Washington, D. C. 1883
Samaniego, Jos. A., M. D.....Ciudad Juarez, Chihuahua, Mex. 1892
Sanchez, Francisco, M. D.....Puebla, Puebla, Mex. 1892
Santa-Maria, Carlos, M. D.....Durango, Mex. 1896
Saunders, Wm., M. D.....Experiment Farm, Ottawa, Ont. 1898
Schmid, Henry Ernest, M. D.....White Plains, N. Y. 1896
Schoonover, Warren, M. D.....115 East 59th St., New York City. 1895
Schmuck, J. Carl, M. D.....Lawrence, Staten Island. 1897
Scribner, Mrs. John H.....Chestnut Hill, Philadelphia, Pa. 1897
Sears, Frederick, M. D.....506 Warren St., Syracuse, N. Y. 1897
Septien, Manuel, M. D.....Queretaro, Mex. 1898
Sewall, Henry, M. D.....23 Eighteenth Ave., Denver, Col. 1894
Shepard, Charles H., M. D.....Columbia Heights, Brooklyn, N. Y. 1892
Shrader, John C., M. D.....Iowa City, Iowa. 1890
Silva, M. O., M. D.....Morelia, Mex. 1892
Slee, Richard, M. D.....Swiftwater, Pa. 1897
Small, Henry Beaumont, M. D.....Ottawa, Ont. 1898
Smart, Charles, M. D., U. S. A.....Washington, D. C. 1882
Smart, G. I., M. D.....Blue Earth, Minn. 1899

Smersh, F. M., M. D.....Owatonna, Minn. 1899
Smith, Charles D., M. D.....Portland, Me. 1885
Smith, Frederick W., M. D.....700 S. West St., Syracuse, N. Y. 1896
Smith, Herbert E.....Med Dept., Yale Univ., New Haven, Conn. 1899
Smith, Theobald.....Forest Hills, Boston, Mass. 1899
Smith, T. Guilford.....Ellicott Sq., Buffalo, N. Y. 1896
Smock, Prof. John C.....Trenton, N. J. 1899
Somerman, Mariano, M. D.....Guadalajara, Mex. 1897
Spencer, James D., M. D.....59 Washington St., Watertown, N. Y. 1896
Sprague, E. K., M. D.....Washington, D. C. 1899
Standlee, Eli L., M. D.....2201 University Pl., St. Louis, Mo. 1895
Stanton, Byron, M. D.....Cincinnati, Ohio. 1889
Staples, Franklin, M. D.....Winona, Minn. 1885
Stengel, Alfred, M. D.....Pepper Laboratory, Philadelphia, Pa. 1899
Sternberg, George M., M. D., U. S. A.....Washington, D. C. 1874
Stewart, Francis E., M. D.,
Merck Building, University Place, New York City. 1897
Stewart, A. H., M. D.....252 No. 12th St., Philadelphia, Pa. 1897
Stillson, H. L., M. D.....Bennington, Vt. 1899
Stokes, Wm. R., M. D.....Baltimore, Md. 1899
Stull, Theodore B.....City Hall, Philadelphia, Pa. 1897
Suiter, A. Walter, M. D.....Herkimer, N. Y. 1894
Suiter, F. C., M. D.....La Crosse, Wis. 1899
Sutherland, Quincy Orlin, M. D..73 Milwaukee St., Janesville, Wis. 1895
Swarts, Gardner Taber, M. D.....Providence, R. I. 1894
Sweetland, John, M. D.....Ottawa, Ont. 1898
Sweetser, H. B., M. D.....Minneapolis, Minn. 1899

Talbot, Miss Marion.....University of Chicago, Chicago, Ill. 1893
Taylor, J. D., M. D.....Grand Forks, N. D. 1899
Tenney, W. A. R., M. D.....Cincinnati, O. 1899
Ten Wergesy, Charles H., M. D.....Wilmington, Del. 1897
Thompson, William, M. D.....1426 Walnut St., Philadelphia, Pa. 1897
Towne, S. R., M. D.....Omaha, Neb. 1895
Tracy, Roger S., M. D.....151 West 106th St., New York City. 1889
Traver, Lorenzo, M. D.....5 Stewart St., Providence, R. I. 1892
Trudeau, E. L., M. D.....Saranac Lake, N. Y. 1899
Tucker, H. G., M. D.....1270 N. Vine St., Nashville, Tenn. 1896
Turner, Thomas J., M. D., U. S. N.....Coldwater, Mich. 1877
Turnbull, Thomas, M. D.....314 Western Ave., Allegheny, Pa. 1897

Utley, Edward R., M. D.....Newton, Mass. 1898

Valentine, Fred C., M. D.....31 W. 6th St., New York, N. Y. 1896
Van Buskirk, W. F., C. E.....Stratford, Ont. 1896
Van Doren, Clarence T.....Harrison, N. J. 1898
Van Norman, E. V., M. D.....Los Angeles, Cal. 1882
Veeder, Major Albert, M. D.....12 Queen St., Lyons, N. Y. 1896
Veeder, Andrew Traux, M. D..Home Office Building, Pittsburgh, Pa. 1896
Verge, W. A., M. D.....Quebec, P. Q. 1894

Wade, John W., M. D.....318 No. 2d St., Millville, N. J. 1897
Wade, Spencer S., M. D.....Morgantown, W. Va. 1892

Wakeman, B. R., M. D.....73 Main St., Hornellsville, N. Y. 1896
Walcott, Henry P., M. D.....Cambridge, Mass. 1880
Walker, Charles R., M. D.....Concord, N. H. 1894
Walsh, Ralph, M. D.....Washington, D. C. 1885
Wallace, Shippen, M. D.....113 Walnut St., Burlington, N. J. 1897
Ward, L. B., C. E.....702 St. Nicholas Ave., New York City. 1885
Wardlow, James S., M. D.....Galt, Ont. 1896
Warner, Frank, M. D.....Columbus, O. 1899
Watson, Irving A., M. D.....Concord, N. H. 1881
Watson, J. Madison, M. D.....Elizabeth, N. J. 1882
Wedgewood, Milton C., M. D.....101 Pine St., Lewiston, Me. 1894
Welch, William M., M. D.....821 No. Broad St., Philadelphia, Pa. 1897
Wende, Ernest, M. D.....296 Water St., Buffalo, N. Y. 1894
Wesbrook, Frank F., M. D.....Minneapolis, Minn. 1897
Weston, Robert Spurr.....14 Beacon St., Boston, Mass. 1896
Whipple, Geo. C.....729 Carroll St., Brooklyn, N. Y. 1899
White, Alfred T., M. D.....Box 619, New York City. 1889
White, William A., M. D.....Box 619, New York City. 1888
Wilbur, Cressy L., M. D.....Lansing, Mich. 1894
Wilkinson, C. P., M. D.....1402 Peters Ave., New Orleans, La. 1889
Willcox, W. F.....Census Bureau, Washington, D. C. 1899
Wilson, Ezra H., M. D.....Hoagland Laboratory, Brooklyn, N. Y. 1897
Wilson, G. H., M. D.....50 Colony St., Meriden, Conn. 1890
Wilson, L. B., M. D.....Minneapolis, Minn. 1899
Wilson, William A., M. D.....310 Paris Ave., Grand Rapids, Mich. 1896
Wingate, Uranus Owen Brackett., M. D.,
204 Biddle St., Milwaukee, Wis. 1890
Winter, Herman, M. D.....Buffalo, N. Y. 1896
Withrow, John M., M. D.....526 W. 7th St., Cincinnati, Ohio. 1897
Woddrop, L. H.....1458 No. 15th St., Philadelphia, Pa. 1897
Wood, Alfred Vincent.....1777 Gloucester St., Brunswick, Ga. 1892
Wood, E. M., M. D.....Winnipeg, Manitoba. 1897
Wood, Prof. Edward S.....Harvard Medical School, Boston, Mass. 1895
Woodbridge, John Eliot, M. D.....637 Prospect St., Cleveland, Ohio. 1896
Woodbridge, Prof. S. H.....Boston, Mass. 1895
Woodhull, Lieut.-Col. A. A., M. D., U. S. A.....Washington, D. C. 1874
Woodward, William C., M. D.....Washington, D. C. 1896
Worcester Free Library.....Worcester, Mass. 1897
Wordin, Nathaniel Eugene, M. D.,
174 Fairfield Ave., Bridgeport, Conn. 1890
Wright, Frank W., M. D.....48 Pearl St., New Haven, Conn. 1889
Wright, H. P., M. D.....Ottawa, Ont. 1898
Wright, James H., M. D.....Mass. General Hospital, Boston, Mass. 1899
Wright, John W., M. D.....Erie, Pa. 1897
Wyckoff, C. C., M. D.....482 Delaware Ave., Buffalo, N. Y. 1896
Wyman, Walter, M. D., U. S. M. H. S.....Washington, D. C. 1884

Young, A. G., M. D.....Augusta, Me. 1885

Zertuche, Emilio, M. D.....Puebla, Mex. 1897

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Whitney, Prof. Eli.....Yale University, New Haven, Conn.
Wood, Mrs. C. P.....108 Powell Ave., Evansville, Ind.

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